Subterranea

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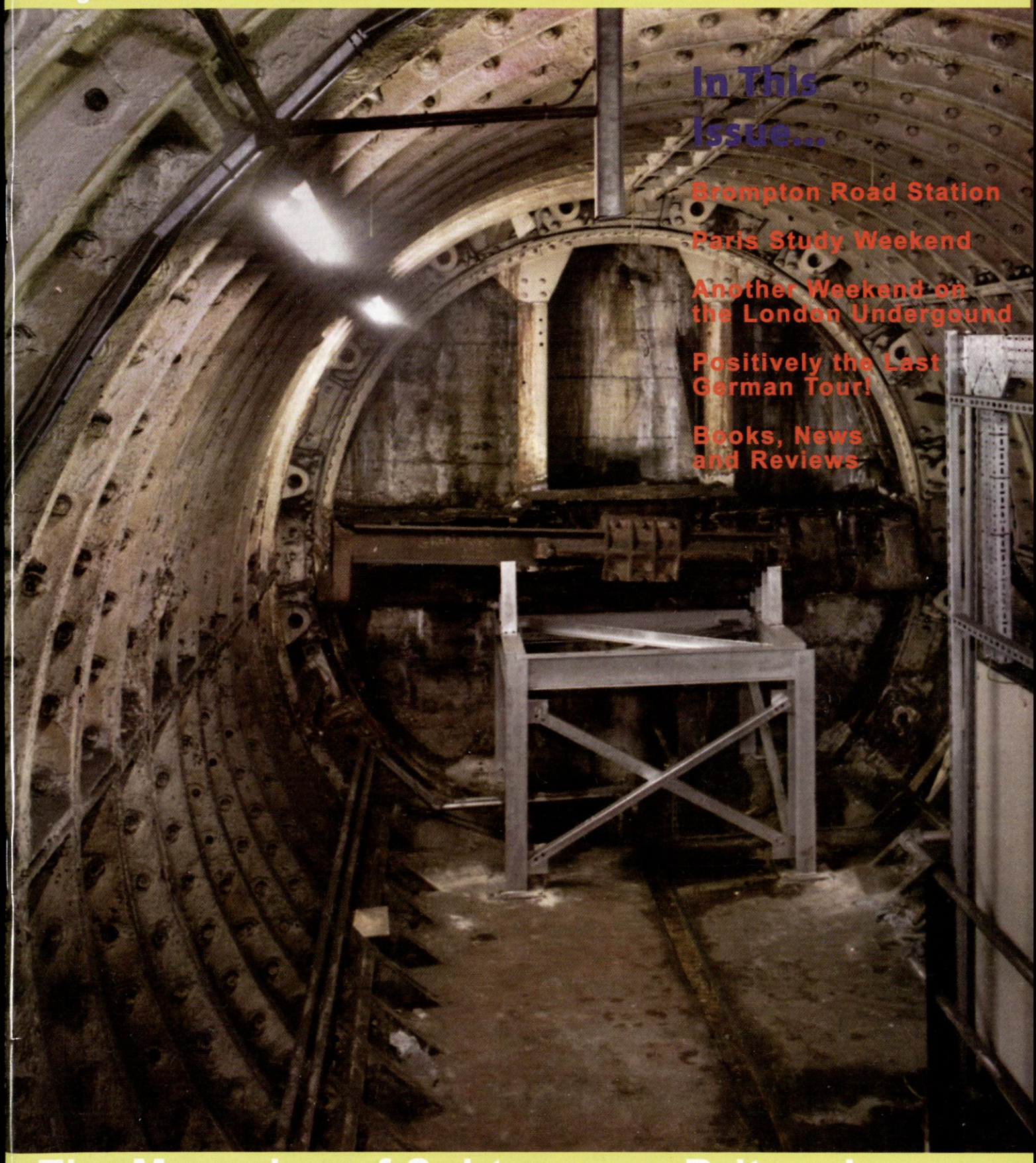

In This Issue...

Brompton Road Station

Paris Study Weekend

Another Weekend on the London Undergound

Positively the Last German Tour!

Books, News and Reviews

The Magazine of Subterranea Britannica

www.subbrit.org.uk

Subterranea Britannica is a society devoted to the study of man-made and man-used underground structures and the archaeology of the Cold War. The main focus of interest is on abandoned and forgotten structures and in the case of Cold War structures studies are entirely confined to declassified and decommissioned structures.
The society is open to all and its membership includes all walks of life. Members are invited to contribute to this magazine even if this just means sending very welcome snippets from Newspapers and magazines.

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Contents

News

Archaeology ____ 2
Conservation & Heritage ____ 2
Defence & Military ____ 5
Mines & Quarries ____ 6
Tunnels & Tunnelling ____ 8
Publications ____ 11
Miscellaneous ____ 15

Features

Who's Who in Sub-Brit ____ 18
Ty Croes Camp, Anglesey, North Wales ____ 19
Armed Forces in East Germany ____ 22
Positively the last German tour! ____ 23
Colonel Stephens' Light Railways and Tunnels ____ 36
Underground Darwin and the Second World War 37
Ghost Metros of Belgium ____ 39
Malmo's 'Crossrail' ____ 40
Another weekend on the London Underground ____ 41
Sub Brit on Mendip ____ 53
Brompton Road Station ____ 55
Possible Medieval Synagogue ____ 63
2008 Europe Study Weekend, Paris ____ 65
Dartford Tunnel Transport ____ 72

Front cover photo: The Greathead tunnelling shield left in place at Moorgate Station in 1904 when the Lothbury extension of the Great Northern & City Line was abandoned.

Rear cover photo Top: Brompton Road Station on the Piccadilly Line of the London Underground closed in 1934, the name can still be seen on the station tiling although it is hidden from passing trains by a brick wall.

Rear cover photo Bottom: The operations room in the 3rd Air Defence Division bunker in Kolkwitz. The bunker was responsible for defending the southern air space of East Germany during the later years of the cold war.

Pictures by Nick Catford

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Newsletters of Subterranea Britannica are published by the committee of Subterranea Britannica. Original articles, book reviews, press cuttings, extracts from books and journals, letters to the editor etc. are welcome. However the editor reserves the right not to publish material without giving a reason.

The committee of Subterranea Britannica and the editor do not necessarily agree with any views expressed and cannot check the accuracy of any material sent in.

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Subterranea Britannica – 35 Years on and a Limited Company

Around 120 members attended the Spring Day Conference at the Royal School of Mines, Imperial College, London, on Saturday, 12 April 2008. Brian Hillman's well-balanced programme of splendidly delivered presentations did not, I am sure, disappoint.

However, there were three short, business meetings before the Conference proper could begin. The AGM of the unincorporated Society was followed by an EGM (Extraordinary General Meeting) of the same body, which endorsed the proposal to incorporate the Society as a Company limited by guarantee. This in turn was followed by an EGM of Subterranea Britannica Limited to endorse some cosmetic changes to our new Articles of Association (which had been carried over without change from our previous Constitution).

The Society, therefore, continues as Subterranea Britannica Limited. The change was made to limit the liability of all members to one pound only in the event of Subterranea Britannica being wound up. Our Constitution, as amended, is now in the form of a Memorandum and Articles of Association as required by the Companies Act. These documents will be circulated in printed form in the next edition of the *Members' Handbook*.

The Society goes ahead under new leadership, Martin Dixon having taken over as Chairman, and Linda Bartlett as Vice-Chairman. Paul Sowan and MC Black remain on the Committee as ordinary Committee members. A profile of Martin appears elsewhere in this edition of Subterranea under 'Who's Who in Sub Brit'.

The feeling of the Committee is that 'Subterranea Britannica Limited' sounds a little over formal. A proposal will be brought to an EGM on the same day as the next Day Conference to revert to using the name Subterranea Britannica (without the 'Limited'). Regardless of whether the proposal is carried, the status of our Society will remain as a Company limited by guarantee and this status needs to be reflected on all official documents and communications. We are also examining the pros and cons of seeking to become a Registered Charity; any proposal will be brought before members at a future date.

SUBTERRANEA BRITANNICA DIARY

Summary of Forthcoming Events

Sub Brit specific events

Saturday 20 September – Open day at Paddock (northwest London)

Saturday October 11 2008 – Autumn Day Conference at Bucks University, High Wycombe

December 2008
"Subterranea" 18 published ** Copy deadline 15 November **

General events

11 – 14 September 2008 Heritage Open Days

19 – 21 September 2008 S.F.E.S Conference - France

20 – 21 September 2008 London Open House

26 – 28 September 2008 - Hidden Earth, OTLEY, West Yorkshire

29 – 30 September, 6 – 7 & 20 – 21 October
Open days at Honecker's bunker near Berlin

News - Archaeology

INVESTIGATION OF COLLIERY SITES AY MIDDLETON PARK, LEEDS, YORKSHIRE

A community archaeology project extending over two winters has been devoted to an examination of Middleton Park, Leeds. There are over 270 known colliery shaft locations, with at least six different styles of coal-mining represented, dating from the 17th to the 20th centuries. A number of shafts were worked using 'cog and rung' horse gins, and there is evidence suggesting a steam engine in 1814. There are also significant remains of waggonways dating from 1758.

Further details may be found at the Friends of Middleton Park's website www.fomp.co.uk .

SOURCE: Martin ROE, 2008, Middleton Park, Leeds. *Newsletter Northern Mine Research Society*, May 2008, page 8.

FURTHER THOUGHTS ON ROYSTON CAVE, HERTFORDSHIRE

Royston, a small Hertfordshire town on the Cambridge border, and its 'cave' (a Scheduled Ancient Monument) is of more than usual interest to Subterranea Britannica members. It is where Subterranea Britannica started, under the direction of our Founder and Honorary Member Sylvia Beamon. Indeed, in our early days, we were once informally referred to as the 'Royston Caving Club!'

A short article in a recent issue of *Local History News* reviews some results of searching the Web for information on this cylindrical subterranean excavation with walls decorated with religious (Christian) carvings. The author notes that, according to various websites, this cave is the 'best kept secret in the UK,' is an 'underground temple erected [sic] by the Templars' (how do you erect a cavity?), 'may hold the key to the Holy Grail', and 'is only comparable to a cave in the Czech Republic.' Your reviewer, having visited Sloup Castle and its rock-cut cave, can vouch for this last claim.

Joanna Mattingley notes previously published accounts of archaeological and historical research, and speculation, by (notably, amongst others) Sylvia Beamon. Joanna goes on to suggest that the excavation may have been commenced as a chalk or flint mine, and was subsequently used as a prison during which time (perhaps the 1480s) the walls were (she suggests) carved. Similar carvings at Carlisle are noted.

The 'cave' is below one of the main roads near Royston's central crossroads, where Ermine Street crosses the Icknield Way. When rediscovered in 1742, it had only an awkward vertical shaft entrance through the ceiling, which makes it sound rather more like a chalk or flint mine than a chapel. As a prison it would be decidedly difficult to escape from. A separate entrance via a steep flight of rock-cut steps had been provided by the 1790s. My own recollection of several visits some years ago is that bands of flints are not conspicuous in the walls; and that there is an old chalk wall associated with the nearby church (chalk, from below the frost-shattered surface layers, was often quarried underground for use as a building-stone). Of course, we may never know why this excavation was made, but can do no more than examine and assess the evidence and theories.

SOURCE: Joanna MATTINGLEY, 2007, Tradition versus history – Royston Cave revisited. *Local History News* 85, 16 – 17.

News - Conservation, Heritage & Tourism

SOUTH CROFTY TIN MINE TO REOPEN, CORNWALL

When South Crofty mine closed in 1998, tin sold at $6,000 per tonne. The market price is now $17,000, as a result of strong demand from China's electronics industry, especially for the manufacture of mobile telephones. The reopened mine is expected to employ up to 400 persons. However, it is suggested that the price of tin could fall again if demand for consumables drops as a result of possible recession in the USA economy.

SOURCE: Marianne BARRIEAUX, 2007, Can tin mining revive Cornish fortunes? *The Guardian*, 1 December 2007, page 48.

DEVELOPMENTS AT JOSEPH WILLIAMSON'S TUNNELS AT EDGE HILL IN LIVERPOOL

The Friends of Williamson's Tunnels (FoWT) trace their origins from 1995, when Steve Moran and Dave Head formed what was at first named the Friends of Williamson's Follies. The group was renamed the following year, launched a website in 1997 (www.williamsontunnels.com), and is dedicated to exploring and securing access to the enigmatic tunnels made in the local red sandstone either side of Mason Street, between Edge Hill and the city centre. Curiously, it is one of two such societies in the city, the other being the Joseph Williamson Society (JWS).

Williamson, for reasons best known to himself, caused to be excavated a number of apparently purposeless tunnels and underground rooms below his house in Mason Street and adjoining land. During his later years (he died in 1841) two railway tunnels were made below Mason Street – one of 2,111 yards opened in 1828 to serve Liverpool's Wapping Goods Station, the other of 2028 yards in 1836 to serve the City's new terminus at Lime Street (replacing the less central earlier Crown Street Station). The Lime Street tunnel was substantially unroofed in the 1880s, so is now in large part the vertical-sided rock open cutting familiar to all who have travelled to or from the terminus.

The two societies' activities are focused on three sites at which access to the tunnels is currently possible. To what extent, if at all, these three sets of tunnels were originally interlinked below ground is not at present clear. After Williamson's death, his tunnels appear to have been used

as convenient places in which to dispose of household refuse, ashes, and rubble from demolished buildings.

The Corporation Stables site, Smithdown Lane

This site lies between Mason Street and Smithdown Lane, the latter running at a lower level than the former. It is bounded on the south side by Grinfield Street, and on the north side by the Lime Street railway cutting. The southern end of the site has now been partially developed with modern housing, although an area (below which a particularly impressive but not yet re-accessed tunnel is thought to run) remains undeveloped. Within this site the Joseph Williamson Society have established a Williamson Tunnels Heritage Centre by erecting a glass screen across the end of one large though short open tunnel; this space contains a bar / café counter and was the meeting place used by the Friends of Williamson's Tunnels when they hosted a memorable International Conference in Liverpool in 2002. Adjoining this space is a small display area, beyond which visitors can walk through a neighbouring smaller but longer tunnel into the cliff, beyond daylight penetration, and re-emerge in the glass-fronted meeting room. Members of the two societies worked jointly on the excavation of this through route.

Williamson's House, Mason Street

Little more than parts of the front and side walls survive of Williamson's house on the City side of Mason Street, the interior being a derelict plot of land, formerly the ground floor. Within this area are two or three holes communicating with parts of the tunnels, including an impressive rock-cut 'banqueting hall' and a former cellar. The Friends have been allowed by the City Council, who own the site, to arrange access for interested persons from time to time, and indeed Subterranea Britannica members visited during the Liverpool Study Weekend in 1999. Liverpool City Council have indicated their refusal to deal with two separate organisations in connection with access to or development of this site, and the two bodies (both registered charities) have now signed a formal agreement to collaborate with each other more closely, possibly leading to amalgamation. Tunnels possibly extend below the former back garden of the house, now shortened by the making and subsequent opening-out of the Lime Street tunnel and cutting. On the Edge Hill side of Mason Street, two houses have displayed signs of subsidence and are being demolished. Further tunnelling is now known to have taken place here as well, as a ten feet long length of tunnel (walled-up at each end) has now been found. In 1832 it is recorded that Williamson operated a quarry here.

Paddington

Paddington appears to have been a once-continuous street running past the north ends of Smithdown Lane and Mason Street, but is now in two parts as a result of its central portion now forming the site of the Archbishop Blanch High School. The Friends' site is at the upper end of Paddington, where it meets Highgate Street. A lease has now been taken on a small area of land otherwise occupied by Liberty Living PLC, and the Friends have secured planning permission for their work, installed mains electricity, and are now preparing to continue the excavation of many tons of rubble from tunnels at present known to exist on three levels. Members of the Friends have undertaken training for working in a 'low risk confined space' under the 1997 Confined Space Regulations, as well as first-aid training.

SOURCE: FRIENDS OF WILLIAMSON'S TUNNELS, 2008, *The Mole* 18: 16 pages.

DRAFT HERITAGE PROTECTION BILL IMPROVES PROTECTION OF UNDERGROUND SPACE

A draft Heritage Protection Bill has been presented to Parliament, 'to make provision about the protection of heritage' with reference to England and Wales, and to English and Welsh waters. Cultural heritage, rather than the country's natural heritage, is meant. If in due course enacted, this will replace the provisions of the *Planning (Listed Buildings and Conservation Areas) Act* 1990; the *Historic Buildings and Ancient Monuments Act* 1953; the *Ancient Monuments and Archaeological Areas Act* 1979; and the *Protection of Wrecks Act* 1973.

The intention is to bring the statutory protection of 'heritage structures', 'heritage open spaces', World Heritage Sites, and 'marine heritage sites' into a single cohesive framework. At present, insofar as 'heritage structures' are concerned, we have Ancient Monuments, and we have three tiers of 'Buildings' listed as of architectural or historical interest. A building Listed as Grade I is reckoned to be of equivalent worth to a Scheduled Ancient Monument.

An aspect of especial interest to Subterranea Britannica is that, ever since the first Ancient Monuments Act in the 1880s, any cave or excavation can be Scheduled. However, as you cannot 'build' a hole in the ground, a cave or excavation cannot be Listed unless, for example, it has a 'built' element such as masonry tunnel portals or linings. A number of tunnel portals are certainly Listed, as is the entire length of Brunel's Thames Tunnel. Currently, a number of objects are both Scheduled and Listed.

Under the proposed new Act, this anomaly is to be removed. A 'registrable' heritage structure could be (a) a building or other structure; (b) an earthwork, field system or other work; (c) a part of a building ... ; (d) a cave or excavation; (e) a site comprising the remains of anything within any of paragraphs (a) to (d); etc.

The Bill also includes 'registrable open spaces' such as gardens or parks, and battlefields; World Heritage Sites

(some of which it may be noted are of 'natural' rather than 'cultural' interest); and marine sites such as shipwrecks.

The greater part of the lengthy text spells out in considerable detail the intended mechanics of registration, appeals against registration, alterations to and deletions from the register, and applications for consent to work at or on a 'heritage structure, open space, etc.', consultation requirements, penalties for failure to adhere to the terms and conditions set out, and so forth. The relevant 'Heritage Authorities' are English Heritage (in England) and the Welsh Minister (in Wales.) The Bill does not extend to Scotland or Northern Ireland.

The text of the Bill is in pages 1 – 128, with explanatory notes in pages 131 – 192.

DETAILS: DEPARTMENT OF CULTURE, MEDIA AND SPORT, 2008, *Draft heritage protection bill, April 2008*. DCMS: (1) + (1) + xi + 192pp [ISBN 978-0-10-173492-9]

BESTWOOD WINDING ENGINE HOUSE, BESTWOOD COUNTRY PARK, NOTTINGHAMSHIRE

A Grade II Listed Victorian colliery winding engine house at Bestwood Country Park is being converted into a new visitor attraction. The £2m scheme includes a glass-sided lift to take visitors to a high-level viewing gallery from which the twin-cylinder vertical engine can be admired, as well as views over the park. A nearby former dynamo house is to become a visitor centre.

SOURCE: *Group Travel Organiser*, May 2008, page 8.

HARD ROCK MUSEUM TO OPEN AT GEEVOR MINE, CORNWALL

The 'Hard Rock Museum' is due to open in an original mine building at the Geevor tin mine, Cornwall, at the end of July 2008. This will tell the story of the Geevor mine, and of Cornish mining in general. Objects, static and interactive displays, restored mine buildings, and computer terminals giving access to a searchable database are intended to be features. The database is intended to grow, and material for inclusion is sought. Contact: Bill Lakin at pch@geevor.com .

SOURCE: ANON, 2008, A mine of information. *Geologists' Association Magazine* 7(2), page 21.

TEMPELHOF AIRPORT DEBATE, BERLIN, GERMANY

The site of Tempelhof Airport, Berlin, has been used for aviation since 1909, in which year aviator Orville Wright made a demonstration flight there. The terminal buildings were commenced in 1923, making them the world's second-oldest commercial airport still in operation. In 1934 the architect Ernst Sagebiel was commissioned by the Nazis to build a mile-long terminal in limestone, said to be the world's third largest building after the Pentagon and Ceausescu's People's Palace. A third of it, reportedly, has never been used. During the Soviet blockade commencing in 1948, the Berlin Airlift kept West Berlin supplied with food and fuel via Tempelhof. At times, a supply aircraft landed every 90 seconds. Not surprisingly, the complex has its own bunkers.

Currently, the terminal hosts flights to 'a handful of obscure destinations,' with most international journeys taking off from or landing at Berlin's Tegel or Schoenefeld Airports. And a new airport, Berlin-Brandenburg, is under construction. The city authorities propose to close both Tegel and Tempelhof, to allow the full development of the new terminal. A referendum was organised for 27 April 2008 to allow Berliners to vote for or against the continuing existence and operation of the historic airport, despite its high running costs. Sadly for the preservationists, insufficient people voted for the result to be accepted as valid. Nevertheless, it was reported that the majority of the 530,231 votes cast were in favour of retention.

SOURCE: Kate CONNOLLY, 2008, Berliners battle to save vast airport that kept the city from starvation. *The Guardian*, 26 April 2008, page 25; and ANON, 2008, Referendum fails to save Tempelhof airport. *The Guardian*, 28 April 2008, page 22.

ADOLF HITLER'S BUNKER RECREATED IN BERLIN, GERMANY

A German equivalent of Madame Tussauds has opened in Berlin. A wax effigy of the dictator, presented as in his final days underground in the Führerbunker, is to be found along with 74 other famous Germans and others, including Albert Einstein, Ludwig van Beethoven, Johann Sebastian Bach and 'an array of writers, artists, and TV personalities.'

SOURCE: Kate CONNOLLY, 2008, Back in the bunker: Hitler returns to Berlin, worried, downtrodden, under guard – and made of wax. *The Guardian*, 4 July 2008, page 24.

A MINE VISIT IN JOHANNESBURG, SOUTH AFRICA

When in Johannesburg, pay a visit to the Standard Bank in Simmonds Street. A lift inside can take you down to visit a 'beautifully preserved access tunnel or stope' in one of the city's earliest gold mines, believed to date from the 1880s – 1890s. It was rediscovered in 1986 during construction of the bank above, and has been incorporated, along with a museum display occupying some 70 square metres. This visit is reportedly open free of charge seven days a week.

SOURCE: Colin PROSSER, 2008, Sitting on a gold mine. *Geology Today* 24(2), 53 – 54.

MIEDZYRZECZ FORTIFIED FRONT (NIETOPEREK BAT RESERVE), WESTERN POLAND

Member Simon Mickleburgh, a bat specialist, has described the 32 km tunnel system forming the Miedzyrzecz Fortified Front (MFF) built by Germany from Spring 1936 onwards to guard the then border with Poland. A total length of 35 km of tunnels, including an underground railway system, had been planned, linking a series of surface fortified bunkers. As Germany invaded Poland on 1 September 1939, its frontier fortifications were left in the rear of the advancing forces, and were not to serve any defensive purpose until the tide of World War II had changed, and the MFF was manned in the hope of holding back the advancing Soviet Army. The Front, reached by the Russians on 29 January 1945, held for only three days, and the conquerors went on to Berlin. The war in Europe ended on 8 May 1945. As a result of the Potsdam Conference in May the same year, the German-Polish border was redefined as following the Odra and Nysa rivers, generally known in the west as the Oder-Neisse Line. This left the MFF, as it remains, in western Poland instead of eastern Germany. Poland however, having gained a part of former Germany, lost territory in the east to Belarus and Ukraine.

The post-war Polish Army acquired the MFF in 1953, but left in 1957, being replaced by a Soviet military base at the northern end until 1994. Anything of any value in the tunnels was stripped out. Plans in 1985 to use the tunnels to dispose of radioactive waste were dropped in 1988.

On 11 August 1980 about a third of the tunnel system was declared a nature reserve (Nietoperek) for hibernating bats. The remainder, with 48 hectares of surface land, was similarly scheduled (Nietoperek II) in December 1998. This site is amongst the most important bat hibernation sites in Europe, with 12 species recorded and up to 37,000 bats counted.

SOURCE: Simon MICKLEBURGH, 2008, Nietoperek – built for conflict but perfect for bats. *Bat News* 85, 6 – 7.

MINERAL EXTRACTION AND THE HISTORIC ENVIRONMENT

English Heritage have published a statement on this topic, an A4 booklet available without charge from English Heritage Customer Services Department (T) 0870-333-1181 or Email customers@english-heritage.org.uk citing product code 51396.

A welcome feature of this statement is that English Heritage recognises that historic mine and quarry sites, at the surface of the ground or underground, may constitute a valuable archaeological resource in themselves. Encouragingly, the booklet includes a diagram of the Grimes Graves flint mines, and a photograph of a group of ten or so persons wearing overalls and helmets appropriate for an underground visit.

DETAILS: ENGLISH HERITAGE, 2008, *Mineral extraction and the historic environment*. English Heritage: 19pp.

News - Defence & Military

PLANNING APPLICATION TO DEMOLISH RAF CHENIES ROTOR RADAR STATION

A planning application has been submitted to Dacorum Borough Council in Hemel Hempstead to allow the demolition of the Rotor Radar station at RAF Chenies in Buckinghamshire. The application includes clearance of the site, construction of a dwelling, garages and stable and reversion of land to agriculture & paddocks.

The prefabricated R8 operations block is the only example still standing but is not eligible for listing as it is classed as a temporary building.

The building was last used by the RAF in the mid 1990s and was listed for disposal in 2004. In recent years it has suffered some vandaslism.

SOURCE: Planning application fixed to the gate.

NORWICH ROC GROUP HEADQUARTERS DEMOLISHED

Demolition of the Norwich ROC Group HQ started in July 2008 and was completed within a few days. The contractors were instructed to raze the building to ground level with all the rubble being pushed into the remaining underground rooms. Nothing was removed from the bunker before demolition started.

The contractors allowed a small party into the bunker to take photographs during the early stages of the demolition.

The bunker was demolished despite no planning permission to develop the site. The owner chose to demolish quickly because of a local campaign to save the building which was getting a lot of support.

In the last 10 years a number of planning applications to develop this prime site on the Norwich ring road have been turned down. These have included a fast food outlet.

SOURCE: Local observation.

WEHRMACHT BUNKER FOUND ON DANISH BEACH

A Wehrmacht bunker has been found under the beach on the North Sea coast of Denmark. It was undamaged and contained furniture and remains of uniforms. In contrast to the end of the German Reich in Berlin, life along the Danish coast had been totally different: "no enemy contact, occasionally a fishing boat towed out a target to sea so that we could practise firing", according to a former soldier who served in the bunker to the end.

Some 2,000 bunkers were built along the Danish coast as part of the Atlantic Wall defence system. The bunker, near Ringkøbing, only came to light a few weeks ago. Drift sand must have covered it shortly after the war, according to the local museum head. It's the best example

of a bunker yet found in Denmark. The bunker, type "Regelbunker (Standard design) 501", is some 20 sq metres in area and housed 10 soldiers. The walls are 2 metres thick. In the bunker there was a boot under the bed, a spanner was lying on the table, together with parts of a telephone which had been dismantled. There were also bottles of ink, remains of uniforms and postage stamps lying under sand.

The Germans capitulated in Denmark on 5 May, 1945, and the soldiers in the bunker had to leave within three days. The five 10.5cm guns of the 5/180 coastal battery had to be left behind; the soldiers were only able to take their personal weapons and kit with them. A possible storm caused water to enter the bunker to a depth of one metre, and the people discovering the bunker had to wade through a 20 - 25 cm deep mixture of salt water, sand and mud. The furniture and metal objects in the bunker have all rotted away or are rusty

Some 8,000 bunkers made up the Atlantic Wall, which was built between 1942 and 1944 over a length of just under 2700 km of coastline. The Wall only had limited value due to its lack of defences in depth.

SOURCE: Der Spiegel 1.7.2008.

RHYDYMWYN IN PEACE, FLINTSHIRE

The World War II Government site at Rhydymwyn, so secret that it was the only secret site never located by German intelligence, has a new lease of life as a closed nature reserve, managed by DEFRA in collaboration with NE Wales Wildlife. Tunnelled storage, commenced in 1938, was used for keeping stocks of mustard gas. And from 1942 – 44 experimental work was carried on in connection with uranium-235 isotope enrichment. Decommissioning of the 35 hectare site commenced in 1959. A recent visit report, by the Botanical Society of the British Isles, reports no rare species, but an impressive species diversity.

SOURCE: Joe PHILLIPS and Delyth WILLIAMS, 2008, Rhydymwyn Valley Nature Reserve, Flintshire (v.c. 51), 9th June. *Botanical Society of the British Isles News* 108, page 60 – 61.

USA NUCLEAR WARHEADS REPORTEDLY REMOVED FROM RAF LAKENHEATH, SUFFOLK

Evidence has been published which suggests that the USA has, quite possibly some years ago, removed the last 110 'free fall' nuclear weapons from English soil, where some have been stored during the last 54 years. 'Gravity' or 'free-fall' delivery from over-flying aircraft is presumably outmoded by the inter-continental ballistic missile, and by firing from submarines. A USAF document on inspections of US nuclear sites, released in January 2007, includes a note stating 'not applicable to Lakenheath.' Further information is reportedly at http://www.fas.org/blog/ssp/ .

Britain's nuclear weapons are designed and built at Aldermaston and maintained at Burghfield (both near Reading) but operationally based in anti-nuclear Scotland! Neither the British nor the US governments comment on the whereabouts or transportation of nuclear weapons.

SOURCE: Julian BORGER, 2008, US removes its nuclear arms from Britain. *The Guardian*, 26 June 2008, page 12; Ian DAVIS, 2008, Nuke-free England. *The Guardian*, 27 June 2008, page 37.

News - Mines & Quarries

ELM PARK UNDERGROUND BUILDING-STONE QUARRY, GASTARD, CORSHAM, WILTSHIRE

Elm Park mine (ST 885683) at Gastard, near Corsham, commenced quarrying dimension stone underground in the early 1920s, this work continuing until 1936 when it was requisitioned for RAF storage purposes. There were attempts to secure and activate planning permission for the recommencement of quarrying in 1988 and 1990, and eventually permission was granted in 1997 time-limited to 31 December 2003. In November that year, planning permission was extended to 31 May 2010. Since 1997 the operation has changed hands 'at least three times', the current operators being Wessex Dimensional Stone Ltd, who also quarry stone underground at Chilmark, near Tisbury. At some point since 1997, the quarrying has been extended beyond the permitted area. Local residents have complained about noise from the underground quarrying affecting their enjoyment of their homes (sound carries well through solid rock.)

The underground quarry, to which access is gained via a slope-shaft, has an area of 2.3 hectares, and lies 20 to 30 metres below ground level.

Consideration is being given to changing working methods, to alleviate the sound problem, and to an application for retrospective planning permission for the area worked beyond the originally permitted limit. Current proposals are to quarry a further 47,024 tonnes of stone over the next 15 years, the material to be brought to surface by fork lift truck for onward transportation by flat-bed lorry. The current planning permission allows an extraction ratio of 60% (leaving 40% of the stone unworked in roof-support pillars), with roadways no wider than 4.88 metres, and pillars 6.1m x 12.8m. Application is being made for permission to drive roadways up to six metres wide, with nine metre square pillars allowing a floor to ceiling height of nine metres, representing an extraction ratio of 64%. Roof-bolting is envisaged. Some doubt has been cast on the acceptability of the plans.

SOURCE: ANON, 2008, Elm Park mine. *Mineral Planning* 116 (April 2008), page 12.

TWO APPARENTLY HITHERTO UNRECORDED PRESUMED OIL SHALE MINE DRIFTS NEAR WEST CALDER, WEST LOTHIAN

Access via roof-falls has been reported to two mine drifts, assumed to be parts of a former oil shale mine, about four kilometres south of West Calder. Two abandoned brick buildings with concrete roofs stand nearby, and may have been functionally associated with the tunnels. The original drift portals are bricked up.

The northern drift is of rectangular cross-section, dipping downwards at about 15°. A line of steel rails is bolted to the concrete floor. The similar southern drift is wider, and has two sets of rails, with some surviving points at the up-dip end, and numbered refuge alcoves in the walls every 10 metres or so. After some 40 metres the tunnel is of unlined rock-cut construction. Fragments of un-processed shale and coal are reported. The lower end of the drifts are flooded or blocked by debris including a dead sheep.

The mine apparently is not one already identified as a recorded named site, such as Baads or West Mains Mine.

SOURCE: Roger GALLOWAY, 2008, Meet report – an unknown mine. *Bull. Grampian Speleological Group*, 4th Series, 3(4), page 12.

SALT MINE GROUND STABILISATION AT NORTHWICH, CHESHIRE

Four brine-filled abandoned salt mines at Northwich have been filled, safeguarding 32 hectares of land in and around the town formerly at risk of subsidence. Grout made from pulverised fuel ash from coal-fired power stations mixed with saturated brine was used. The filling project has been awarded the Institution of Civil Engineers' *North West Merit Award* for 2008, and the *Ground Engineering Stability Award* for the same year. Support pillars of rock-salt left *in situ* during the active life of the mines had, subsequent to their abandonment, been dissolved away by surface water which had got into the mined cavities via the old access and winding shafts. Saturated brine was used in the grout as, of course, this would be unable to dissolve any more rock salt.

SOURCE: ANON, 2008, Pioneering mine filling plan wins new honours. *Weekly Guardian* [Cheshire], 19 March 2008, page 9.

BATH STONE QUARRIES, COMBE DOWN, BATH

The 18th century underground building-stone quarries at Combe Down, at the top of the hills to the south of Bath, are being almost completely filled with foamed concrete. Some very limited access is being retained, with massive steel supports, to allow for hibernating bats, and to preserve an 'archaeological sample' of the quarry.

SOURCE: Alan GRAY, 2008, Some serious shoring. *Descent* 201, page 11.

COMMERCIAL GOLD MINING TO COMMENCE AT TYNDRUM, SCOTLAND

An Australian company, Scotgold, has purchased the Cononich mine near Tyndrum, about 40 miles north of Glasgow, where they have a licence to extract gold from an area of 2,700 square kilometres of land. This is likely to mean the crushing and screening of vast quantities of rock which will presumably be left behind after the minute gold content has been removed.

SOURCE: ANON, 2008, Mining news. *Descent* 201, page 8.

RÓKHAGI COAL MINE, SUΔUROY, FAROE ISLANDS

Unlike well-documented Iceland, the similarly almost entirely volcanic (albeit long-since extinct) Faroe Islands had little on the way of an overall single publication on the archipelago's geology until Jóannes Rasmussen and Arne Noe-Nygaard's *Geology of the Faeroe Islands* published in 1970 as *Danmarks Geologiske Undersøgelse*, 1st Series, number 25.

The search for winnable oil has extended from offshore sedimentary rocks to submarine volcanics, including the much-fractured basalts of the Brito-Arctic Province extending from the Hebrides and Northern Ireland, via Rockall, the Faroes and Iceland, to Greenland. Oil and gas were found in inter-basaltic sandstones in the Faroe-Shetland Basin in 2004. The Jóannes Rasmussen Conference, named in honour of the co-author of the above-mentioned publication, was held recently in Tórshavn (capital of the Faroes) and included field excursions on some of the 17 or so inhabited islands in the group.

Of particular interest was an underground visit to the abandoned Rókhagi coal mine adit (reputedly negotiable for some 200 metres) in a mountainside on the largest of the southern islands, Suðuroy. Two photographs of the mine portal published in the report cited here indicate a comfortable standing-height tunnel around 1.5 metres wide, with a single narrow-gauge railway track. Although mining is known to have been commenced in the 18th century, and there have been studies of resources from time to time, it is thought that the working here has been inactive for some decades at least. Perhaps, as with similar lignite beds between lava flows in Iceland, it was in production primarily during the First and/or Second World Wars, when importation of coal was problematic. Neither the Faroese nor the Icelandic coal seams outcrop in areas well served by road links or harbours. This coal is, of course, not of Carboniferous Age, but dates only from the Eocene. Jurassic coal was worked until quite recently at Brora, in Scotland. And other coal younger than the Carboniferous is still worked by a Russian concern on Svalbard (Spitzbergen) by agreement with Norway.

SOURCE: Simon PASSEY, 2008, Basalt and the bits in between... *Geoscientist* 18(4), 18 – 23.

IMPORTANT MANUSCRIPT MAP OF 18thCENTURY MINING RIGHTS IN SWALEDALE, NORTH YORKSHIRE

The Northern Mine Research Society has, with others, contributed towards the purchase price (£1,000) of a unique coloured map, dated 1707, showing lead mining rights on Grinton How in Swaledale. The map, now in the North Yorkshire County Records Office, was created in connection with a court case about mining rights instigated in 1705. Apart from its mining history interest, this is the earliest known detailed map of the Dale. An exact copy has been made and presented to the Swaledale Museum.

SOURCE: Alan MILLS, 2008, Preserved for posterity – the Society helps the North Yorkshire County Records Office purchase a map. *Newsletter Northern Mine Research Society*, May 2008, 6 – 7.

News - Tunnels & Tunnelling

HISTORIC RAILWAY TUNNEL SHAFTS DEMOLISHED

Network Rail has capped and demolished four brick ventilation shafts running along the Prince of Wales Tunnel in Shildon, Co. Durham. Although believed to have been rebuilt early in the tunnel's life, the shafts were originally sunk when the tunnel, which is still used today, was built in the 1840s.

SOURCE Northern Echo 10.4.2008

DISUSED RAILWAY TUNNEL TO BE CONVERTED INTO UNDERGROUND HOSPITAL

Disused railway tunnels under Lord's cricket ground are set to be converted into London's first underground hospital.

The Wellington Hospital is in talks with the MCC to create a £100 million subterranean care centre that would house a suite of operating theatres, intensive care facilities and hi-tech scanning equipment three storeys down. The Victorian tunnels which were adjacent to the Great Central Line north of Marylebone. They are on the down side of the line which is not underground and were used for stabling empty carriage stock

They would be part of the existing hospital, which is already Europe's largest private healthcare facility. Plans are also being drawn up to build a world-class sports medical centre as part of a £200 million redevelopment of Lord's. The Wellington is in discussions with the Rifkind Levy Partnership which leases the tunnels from Network Rail, and the MCC, which owns the top 18 inches of ground. Other proposals for the tunnels include an entertainment complex and a Lord's cricket academy.

Subterranea Britannica was called in to investigate the tunnels in c.1998 when contractors broke into the tunnels while extending the Wellington Hospital's underground car park.

SOURCE: *Evening Standard.*

HOUSE UNDERMINED BY TUNNELLING ENTHUSIAST, HACKNEY, LONDON

William Lyttle (77), a retired engineer, has been ordered to pay almost £300,000 for stabilisation works at his home in Hackney where, for 40 years, he has been burrowing underneath the 20-room Victorian house and adjoining land. He was evicted from the property in 2006 to allow engineers to stabilise the building, adjoining property, and the pavement at the front.

SOURCE: Lara DEAUVILLE, 2008, Pensioner ordered to pay up for digging under his home: Mole man is £293k in the hole. *The London Paper*, 15 April 2008, page 4.

NATIONAL GRID CABLE TUNNEL, LONDON BOROUGH OF CROYDON

Work continues steadily on the National Power electricity cable tunnel being driven from east to west below the entire width of the London Borough of Croydon. It is to take a replacement for a 275 kv subsurface cable, with provision for additional capacity if or when required.

The tunnel, entirely in Upper Chalk, commences on the LB Bromley border near New Addington, with a spoil extraction shaft near the junction of Kent Gate Way (A 2022) and Gravel Hill (A212). There is another shaft beside the Croydon Tramlink stop at Lloyd Park, on Coombe Road (A212), and a final one on the LB Sutton border in the Beddington / Waddon area near the site of the former Croydon B Power Station (of which only the chimneys survive, next to the IKEA premises on Purley Way (A23). Tunnelling towards New Addington and beyond (eastwards) is completed, and westwards towards Lloyd Park was (early in 2008) due to start 'very soon' with completion to that point expected in June / July 2008 and the final length towards Beddington due to be completed by November 2008.

SOURCE: Sara BASHFORD, *et al.*, 2007, National Grid. *Selsdon Gazette* 60(671), page 8; Sara BASHFORD, Phil THOMAS, and Dudley MEAD, 2008, National Grid Croydon Cable Tunnel Project. *Selsdon Gazette* 60(680), page 8.

SPRINKLER SYSTEM FOR THE DARTFORD TUNNELS, KENT / ESSEX

Following a number of disastrous fires in mainland European road tunnels, an appraisal of British road tunnels' safety arrangements (or lack of them) has led to consideration being given to the installation of a fire sprinkler system in the Dartford (Kent) – Thurrock (Essex) tunnels.

One relevant factor in the Dartford tunnels case is that the two bores are linked by only a single cross-passage. This narrow, sloping tunnel section was made to assist in tunnelling, and is unsuitable for emergency access in the event of a vehicle and its load catching fire in a running tunnel.

SOURCE: Ed OWEN, 2008, Dartford tunnel to retrofit fire sprinklers. *New Civil Engineer*, 17 January 2008, page 6.

THE OTHER CROSSRAIL PROJECT, GLASGOW

Glasgow has had an east-west cross-city operational railway service, linking High Street, Queen Street, and Charing Cross and places further out, for years. It also has a resource of abandoned viaducts and tunnels available for reuse.

Strathclyde Passenger Transport has published plans for a three-phase development of a separate north-south Glasgow Crossrail, the first stage of which could be operational in time for the Commonwealth Games in 2014. It has been estimated that more than four million passengers would use such a service at projected new stations at Glasgow Cross, Gorbals, and West Street. The line would also connect Glasgow Central and Glasgow Queen Street Stations.

SOURCE: ANON, 2008, Phased plans for Glasgow Crossrail. *Modern Railways* 65(717), page 7.

UNDERGROUND CITY PLANNED FOR AMSTERDAM, THE NETHERLANDS

Amsterdam suffers from congestion. A solution under consideration currently is the Alternative Multi-Functional Underground Area Amsterdam (AMFORA) which envisages six levels of new usable space below the city's canals, occupying an area of six million square metres. Much of Amsterdam's traffic might be taken underground, and the noxious exhaust fumes filtered out. The space would be created by draining the canals, emplacing diaphragm walls, and sealing the upper surface with a 28 metre thick clay seal, before returning the water.

SOURCE: Jessica, ROWSON, 2008, Urban regeneration: underground city for Dutch. *New Civil Engineer*, 14 February 2008, 12 – 13.

EAST LONDON LINE / THAMES TUNNEL CLOSED TEMPORARILY, LONDON

London Underground's East London Line, including the Thames Tunnel, closed to traffic after the last services of 22 December 2007. Buses are replacing trains until the line reopens, under new management as a part of 'London Overground', in the summer of 2010, when it will be a part of the national rail system, not a part of London Underground.

The Thames Tunnel has in fact been closed quite recently, 1995 – 1998, for refurbishment. It was Listed Grade II on 24 March 1995.

The line had its origin in the Thames Tunnel built by Marc Isambard Brunel and his son Isambard Kingdom Brunel during the years 1825 – 1843. Although intended to be for road traffic, it was never completed with road access at either end, and was used only by pedestrians from 1843 until 1869, when it was incorporated with effect from 7 December that year in the East London Railway, with tunnelled and surface extensions, ultimately, to termini at Whitechapel (Low Level) at the north end, and New Cross and New Cross Gate at the south end. There was a single connection via St. Mary's Curve, at Whitechapel, with the remainder of what became the London Underground system. This is now redundant, as the line will reopen with the 'Southern Electric' style third rail system, the Underground third- and fourth-rail system being abandoned for the London Overground development. St. Mary's Curve (in tunnel) has had no passenger services since 6 October 1941, but has been used for empty stock movements, such as the transfer of carriages to Neasden for repairs. The 'Overground' will of course still run underground through the Thames Tunnel! This reminds one of the Liverpool Overhead Railway's southern terminus at Dingle, at the end of a tunnel!

The newly redeveloped line will be extended northwards of Whitechapel to serve new stations (or in some cases reopened stations) at Shoreditch High Street, Hoxton, Haggerston, and Dalston Junction, terminating in 2011 at Highbury & Islington. South of New Cross Gate, the new services will run to Crystal Palace (the former Low Level Station) or West Croydon. A new train depot at Surrey Quays will replace an older LT depot at New Cross.

SOURCE: Trevor BAKER, 2008, Farewell to Underground Services on the East London Line. *London Railway Record* 55, 38 – 42.

SOURCE: J.E. CONNOR, Trevor BAKER, and P.P. RIDDLER, 2008, The East London Line in recent years. *London Railway Record* 55, 43 – 56.

A3 ROAD TUNNEL CONSTRUCTION, HINDHEAD, SURREY

A twin-bore 1.9 km road tunnel is being bored on the A3 near Hindhead, Surrey. Balfour Beatty and the National Trust have issued details of public viewing platforms from which work in progress can be watched at the north and south portals. There is also a staffed visitor centre, open at advertised hours.

The new tunnel takes the A3 away from, and underneath, the Devil's Punch Bowl Site of Special Scientific Interest. The stretch of the A3 to be bypassed will be taken out of commission as a road and 'returned to nature' in this area of outstanding landscape quality. The two bores will have numerous cross-passages in case of fire or other emergencies. The north portal is to the south of Boundless Wood, from whence the bore goes southwestwards and then curving to westwards under Gibbet Hill and Hindhead Common, emerging at the south portal near Tyndall's Wood. Completion is expected in 2012.

SOURCE: HIGHWAYS AGENCY, 2007, *A3 Hindhead Improvement Scheme plan and programme*. Highways Agency: 6pp.

STONEHENGE ROAD TUNNEL PROPOSAL RESURFACES, WILTSHIRE

Three months after the Government abandoned the proposal for a road tunnel to remove the A 303 from the historic landscape around Stonehenge, on grounds of cost, the debate is re-opened. This results from Tesco's plans for an enormous 85,000 square metre distribution centre on a 50 hectare site to the east of the monument. It appears that one in five of the hundreds of lorries serving the supermarket's site would pass the stones.

SOURCE: Damian ARNOLD, 2008, Tesco puts Stonehenge tunnel back on agenda. *New Civil Engineer*, 28 February 2008, page 6.

OLIVE MOUNT RAILWAY TUNNEL TO BE REOPENED, LIVERPOOL

The short double-track single-bore rail tunnel on the out-of-use Olive Mount chord, between Broad Green and Edge Lane stations, is proposed to have track reinstated to facilitate freight train movements near Edge Hill, Liverpool.

SOURCE: James ABBOTT, 2008, An expansive vision for Merseyside. *Modern Railways* 65(718), 56 – 63.

THE BRITAIN – IRELAND TUNNEL SCHEME – AGAIN

Proposals for a rail tunnel to link Great Britain to Ireland have been discussed for over a century. Early on, the favoured (because shortest) route was from near Campbeltown in Kintyre to Northern Ireland, although of course is was pointed out that the route thence from Glasgow would have been so circuitous (unless two more undersea tunnels from the mainland to Arran and from Arran to Kintyre were also made) that it would be no quicker to Ireland by train than by ferry from Stranraer!

The Association of Train Operating Companies has now revived the rail tunnel to Ireland suggestion, focusing on three possible routes: Stranraer to Larne (Northern Ireland); and Holyhead to Dublin or Pembroke to Wexford (Republic of Ireland.) One Jackie Skipper, a senior geologist with the Geotechnical Consulting Group, has described the revived project as 'slightly more difficult' than the Channel Tunnel (which ATOC would like to see duplicated to increase rail capacity to and from mainland Europe). Tunnel Boring Machine design has advanced significantly since the three existing Channel Tunnel bores were driven. And, in fact, the Channel Tunnel was a relatively simple job in engineering terms - it took so long to become a reality as a result of political and financial problems. Skipper favours the Scotland – Ulster route, as shorter than those to the Republic and, so far as current knowledge goes, posing fewer geological problems.

Another tunnelling expert has described the project as 'technically possible' but 'the business case just doesn't stack up.' A recent report suggests that the idea of an Anglo-Irish tunnel 'was first given serious consideration' in the late 1990s, following undersea tunnelling experience with the Øresund tunnel successfully completed between Denmark and Sweden. The Irish Sea is, in the relevant area, of the order of 100m deep. An immersed tube tunnel, a series of concrete boxes joined end to end and laid in a dredged sea-floor trench, has also been suggested for the 85 km from Holyhead to Dublin. Presumably any route chosen should this option be taken would avoid the quantities of British poison gas dumped in the Irish Sea after World War II!

SOURCE: Seán FLYNN, 2008, Ambitious plans for tunnel to link Britain and Ireland. *New Civil Engineer*, 17 April 2008, page 10 [with additional Subterranea Britannica editorial content and comment].

TWO NEW RAILWAY TUNNELLING PROJECTS, DUBAI

Despite its explosive growth, Dubai has so far lacked a public mass transit system. This deficiency is now being rectified by the construction of the first two of, possibly, four new metro lines. Until the commencement of London's Crossrail, this is reckoned to be the world's largest infrastructure project. Tunnelled sections at the city centre will amount to 11 km, not far short of Crossrail's 16 km. The Dubai system will have double track in single bore 8.5m diameter tunnels, compared with Crossrail's twin 6m diameter bores.

The Red Line, of 47 km, will extend from Jebel Ali in the west, the overground part largely on piers, with four subsurface stations in the city. This is said to be equivalent to the distance from Heathrow London Airport to Epping. The much shorter Green Line is to pass below Dubai Creek, with six underground stations on a route from Festival City to Rashidiya. Tunnelling is largely in wet sand. Settlement at the surface has been less than 15 mm, and indeed mostly less than 5 mm.

SOURCE: Ed OWEN, 2008, Dubai Metro: green line. *New Civil Engineer*, 6 March 2008, 24 – 25.

NEW METRO RAILWAYS FOR NEW DELHI, INDIA

Delhi is constructing a vast mass of new transportation infrastructure, including a trebling of the city's metro, in readiness for the Commonwealth Games in 2010. An additional 120 km of lines are being constructed underground and as elevated surface sections.

SOURCE: Jackie WHITELAW, 2008, Deadline Delhi: a transport revolution in New Delhi has an unbreakable deadline of 3 October 2010, the start of the Commonwealth Games. *New Civil Engineer*, 28 February 2008, pages 20 – 22.

PROPOSED HAMPSTEAD HEATH TUNNEL BLOCKADE, LONDON

It is proposed to close Hampstead Heath tunnel, on the North London Line, for three months. This is to allow the trackbed and track to be lowered to allow for larger

container trains using this route. The tunnel was last closed in 1995 – 96 in connection with refurbishment to allow its use by 'Regional' Eurostar trains bound for the East Coast Main Line (which, in fact, never ran!).

SOURCE: ANON, 2008, Hampstead Heath tunnel blockade in prospect. *Modern Railways* 65(715), page 14.

INFILLING UNINVITING PEDESTRIAN SUBWAYS AT ROCHDALE, LANCASHIRE

Pedestrian subways under road 'improvement' schemes have never been hugely popular (except, presumably, with motorists)! Often smelling of urine, decorated by graffiti artists, and potentially harbouring drug-pushers, drunks, and muggers, they represent the unattractive underbelly of urban roads for the motoring fraternity.

Some such are now being abandoned on a road scheme near Rochdale, where a gyratory system is being replaced by traffic-light controlled pedestrian crossings. This presented the problem: what to do about the old subways?

Bricking-up the under-road tunnels was considered to be an unacceptable option. After all, a bricked-up tunnel is always seen as a challenge! Infilling the bricked-up cavities with concrete would have been expensive, and a disruptive operation calling for road closures for the parking of numerous ready-mix concrete trucks. The solution adopted is to use an expanding resin foam mix which can be rapidly pumped into the cavities from up to 150 metres away via flexible plastic pipes. Each supply lorry carries enough amino-plastic resin and hardener to fill about 100 cubic metres of void. Once mixed within the cavities, the components expand to around 12 times their original volume, and set hard in about two hours. The resulting expanded foam has a density of about 30 kg per cubic metre, and is strong enough to provide some structural support if needed. Presumably, behind the bricked-up subway entrances, it is not readily re-excavatable by urban explorers! Perhaps, too, some of these burrows may indeed be re-excavated 50 years or more in the future, by archaeologists anxious to record graffiti as representative of the culture of the 1970s! After all, we are now re-excavating sealed World War II air-raid shelters! Perhaps a 'pristine' graffiti-decorated subway might be Listed and preserved by English Heritage as an important sample of how we used to live! With or without the smells!

SOURCE: Adrian GREEMAN, 2008, Foamtastic: contractors have been using high-volume resin foam to fill in old subways on a Rochdale road scheme. *New Civil Engineer*, 10 April 2008, page 42 [With additional comment].

DUBLIN PORT ROAD TUNNEL OPENED 2006 CLOSED 2008, IRELAND

The Dublin Port Tunnel opened to road traffic (£228m over budget) in December 2006. It was closed to traffic on 27 February 2008, 'causing traffic chaos in the city.' The problem has been identified as faults detected in the vehicle height detection system, fire suppression mechanisms, and CCTV and emergency lighting systems. The National Roads Authority is pursuing tunnel contractors Nishimatsu-Mowlem-Irishenco for 'several million Euro' in compensation to rectify the detected faults.

SOURCE: Damian ARNOLD, 2008, Legal claim follows Dublin fault. *New Civil Engineer*, 6 March 2008, page 12.

AMBITIOUS TUNNELLING PROPOSALS FOR BHUTAN

Bhutan, with a population of just 700,000, is a landlocked state in the eastern Himalaya, between India and Tibet. The government has received an initial study for a network of road tunnels conducted by the Norwegian Geotechnical Institute, in collaboration with Bhutan's Department of Geology and Mines. Ten possible tunnels have been identified to link urban centres and key infrastructure, including a proposed hydro-electric power plant, and a proposed new airport.

A map accompanying a recent report indicates a possible tunnel of the order of eight kilometres long to link Paro Airport to Jamdowom or Langdru, shortening the existing road route via Chungkana and Kharbi on the Paro – Thimpu road.

Tunnelling in the 'fragile and highly sheared' rock is 'expected to present complex technical challenges' and call for extensive rock-bolting and use of shotcrete (sprayed concrete tunnel lining).

SOURCE: Mark HANSFORD, 2008, Tunnelling project set to transform Himalayan kingdom of Bhutan. *New Civil Engineer*, 10 April 2008, page 18.

News - Publications - Books

HOW ARE THE NEWS ITEMS, ABSTRACTS AND REVIEWS COMPILED?

Most of the news items, abstracts of new publications, and reviews of new books are compiled by former Subterranea Britannica Chair Paul Sowan. It is only rarely that we receive without charge copies of books for review. Most of the published material noticed in these pages is from his own personal library. Apart from buying a great many books, Paul subscribes to almost 100 societies and magazines. Quite expensive, but 'retired rate' subscriptions and two honorary memberships lessen the cost! And of course access to the British Library, the Geological Society of London's Library, and others is more than helpful. Added to which, several members and others kindly send in relevant news-cuttings, photocopies of magazine articles and so forth. Thanks for many such are offered to, *inter alia*, Derek Bayliss (Sheffield), Ivor Brown (Wakefield), Martin Dixon (Ascot), Harry Pearman (Crayford), and Adam Sowan (Reading). Newscuttings and periodical articles should

be annotated with periodical name, date of publication, and volume, part and page numbers where applicable, please.

THE BRUNELS' THAMES TUNNEL, LONDON

A booklet previously published in 1992 by the Brunel Exhibition Centre at Rotherhithe has been revised and updated, and published in collaboration with the Institution of Civil Engineers (ICE). This is probably the most authoritative, best-presented and most accessible and affordable account of the Brunels' tunnel currently available, and is highly recommended.

DETAILS: Andrew MATHEWSON, Derek LAVAL, Julia ELTON, Eric KENTLEY, and Robert HULSE, 2006, *The Brunels' tunnel*. London: Brunel Museum: 84pp [ISBN 978-0-9504361-2-8] [On sale at £5 at the bookshop at the Institution of Civil Engineers at 1 Great George Street, London SW1].

SNAILBEACH LEAD MINE, SHROPSHIRE

The Snailbeach mine (SJ 375022), around two miles south of Minsterley, appears to have been worked from Roman times until 1955. Primarily a lead mine, exploiting the ore galena, it also produced significant quantities of barytes, and smaller quantities of zinc ore (sphalerite), calcite, and fluorspar. An unusually complete set of surface buildings survives, and the County Council along with the Shropshire Mines Trust have restored many of these and associated structures, allowing public access. Guided tours underground are also on offer by arrangement, although the lowermost parts of the 1,650 feet deep workings are now flooded and inaccessible.

A new and highly recommended book, co-authored by 18 members of the Shropshire Caving and Mining Club and the Shropshire Mines Trust, edited by Adrian Pearce, has been published for the Trust by Peter Burgess. The book's stated target audience is a 'general readership' rather than mining experts, in which aim it is undoubtedly successful. The main chapters commence with accessible accounts of the geology and history of the site. The 'human interest' element is addressed through chapters on living conditions, working conditions, and the George's Shaft disaster of 6 March 1895 when a broken steel winding rope precipitated seven men to their deaths at the bottom of a 252-yards deep shaft.

Another chapter deals with the freight-only narrow-gauge Snailbeach District Railway, opened from Pontesbury in 1877. Three miles or so of track ran to Snailbeach and other nearby mines and roadstone pits. Although six locomotives worked the line at various times, after 1946 trucks were hauled back and forth on the rails by an agricultural tractor, until the line closed in 1959.

A useful location map and a clear and detailed plan of surface remains accompanies a 'surface tour' chapter for self-guided visitors. On occasions, some of the buildings and their contents are also manned and open to the public. Another chapter on underground tours stresses that these are by arrangement only, under the guidance of appropriately experienced leaders. The general public can be shown a limited area of underground workings. Persons wishing to see the lower levels can do so only after training in vertical caving methods of descent and ascent, such as SRT ('single rope technique.'). The volume is completed with a short account of wildlife at the site, both at the surface and underground.

There is generous provision of black-and-white photographs and line drawings. These include about 50 views, both historical and modern, of surface scenes and structures; over 20 underground views and a mine plan; depictions of mining artefacts and railway track and rolling-stock; and so forth. Numerous drawings by the late Malcolm Newton add materially to the attractiveness of the volume. Photographs of 11 mineral specimens, being in black-and-white, are perhaps not very successful, although much more helpful colour versions of six of the same are on the back cover. The front cover has an attractive sunset view of a restored winding gear headframe.

There is a seven-page bibliography, a five-page glossary of mining terms, but no index. Further information can be obtained at: http://www.snailbeachmine.org.uk and http://shropshiremines.org.uk .

DETAILS: Adrian J. PEARCE (edr), 2008, *Snailbeach lead mine, Shropshire*. Shropshire Mines Trust Ltd / Peter Burgess: 172pp [ISBN 978-0-9556081-2-4] [£9.50 + £1.50 p/p payable to Shropshire Mines Trust Ltd from Mike Moore, 53 Vineyard Drive, NEWPORT, Shropshire TF10 7DF].

MADELEY WOOD COLLIERY, SHROPSHIRE, 1830s – 1967

This detailed and authoritative account of the Madeley Wood colliery near Ironbridge, Shropshire, has been compiled by Dr. I.J. Brown, who was employed there during the years 1952 – 62 when he was training as a mining engineer. His father John Henry Brown [1905 – 1990] had also worked in the Shropshire collieries for over 50 years, and his wife's family were also in coalmining. This account, with numerous historical map extracts and photographs, describes amongst other matters the history and technological development of the colliery, up to its closure by the National Coal Board in 1967. Ivor Brown, on leaving the mine, went on to a career which included lecturing in mining, the engineering of land reclamation at Telford New Town, and serving as a minerals planning officer in Yorkshire. Voluntary societies such as the Shropshire Caving and Mining Club have been fortunate to have such a professional amongst their active membership.

DETAILS: Ivor J. BROWN, 2007, Madeley Wood Colliery Halesfield and Kemberton Pits (from the 1830s to July 1967) A selection of articles by Dr. Ivor J. Brown (2007). *Shropshire Caving and Mining Club Account*

26: 85pp [Available at £6 + £1.50 p/p from Mike Moore, Moore Books, 53 Vineyard Drive, NEWPORT, Shropshire TF10 7DF].

HISTORY OF THE CEIRIOG SLATE QUARRIES AND TRAMWAY, CLWYD

A handsomely produced hardback volume of 212 pages, profusely illustrated with black-and-white and colour illustrations, has recently been published as the first part of an intended comprehensive work on the industrial and transport history of Glyn Ceiriog, in Clwyd. Glyn Ceiriog is the valley running westward from Chirk, near the Clwyd boundary with Shropshire. Chirk Castle overlooks its lower or eastern end. The nearby Chirk Aqueduct (1796 – 1801) on the Llangollen Canal, and the mouth of the valley, can both be admired from trains passing over the 18-span Chirk railway viaduct (timber in 1848, rebuilt in stone in 1859) on the Shrewsbury & Chester Railway.

David Lloyd George once described Glyn Ceiriog as 'a little bit of heaven on earth' and your reviewer's one brief visit recently (to see lime kilns and a natural cave near Castle Mill) leads him to endorse that sentiment. However, the valley has in the past seen mineral workings for slate, granite, silica, and china clay; a gunpowder manufactory; a flannel mill; and the Glyn Valley Tramway. To a considerable extent, slate was quarried underground. John Milner's first volume in what is evidently intended to be a series addresses especially the history of the slate quarrying industry here from 1592 to 1948. His next intended volume in this series, *Rails to Glyn Ceiriog*, is to replace his earlier volume on *The Glyn Valley Tramway*. He has been accumulating material since 1952, and has made extensive use of primary and archival sources.

The bulk of the work is devoted to the Wynne slate quarry, supposedly commenced by one John Wynne [1709 – 1795] (where a slate quarrying museum with associated underground tours operated from 1980 to 1998) and to the Cambrian slate quarry, worked (also in part underground) 1770 to 1947. Shorter sections deal with the Graig-yr-Oryn slate quarry and other minor workings. The impressively comprehensive illustrations depict, *inter alia*, quarry and associated village scenes; relevant people; tools and plant; quarry locomotives, rolling-stock, and track; original quarry documentation from ephemera to colour reproductions of quarry sections and plans (above and below ground); modern surface and underground views; and some very helpful site plans (in colour) relating quarries, quarry buildings and tramways to modern features.

There is a useful bibliography, a glossary of slate-quarrying terms, 13 appendices, and a six-page index.

John MILNER, 2008, *Slates from Glyn Ceiriog: the history of the Ceiriog Valley slate industry 1529 – 1948 and its influence on the creation of the Glyn Ceiriog Valley Tramway. The industrial history of the Ceiriog Valley Volume I.* Chester: Ceiriog Press: 212pp [ISBN 978-1-900622-11-0] [Available at £33 (incl. p/p) from Mike Moore at Moore Books, 53 Vineyard Drive, NEWPORT, Shropshire TF10 7DF.
mike@moorebooks.co.uk www.moorebooks.co.uk.

SECOND EDITION OF MILWR TUNNEL BOOK, NORTH WALES

Cris Ebbs' splendid book on the Milwr tunnel was published in 1993. He has now published, on a 'print-on-demand' basis, a second edition. Details of availability of the black-and-white version (£9 + p/p) or the colour version (£16.95 + p/p) are at www.lulu.com .

The tunnel was driven inland from the North Wales shore from 1897 onwards to drain over 50 mineral-bearing veins, thus allowing lead mining to proceed at the Halkyn mine. By 1957 the tunnel had extended 10 miles inland under the mountain, and was draining some 60 miles of mine tunnels. The tunnel was closed in the 1980s, and the mine ceased work in 1987. The Grosvenor Caving Club negotiated an access agreement, and has to date completed the surveying of some 26 miles of mine tunnels.

A HISTORY OF THE UK'S INDEPENDENT NUCLEAR DETERRENT

Peter Hennessy, a recognised academic expert and author on the Cold War, wrote *Whitehall and the Cold War* in 2002. He has now followed this with *Cabinets and the bomb*, which reproduces and comments on now de-classified Cabinet documents dealing with the political decisions relating to nuclear weapons from the Second World War onwards.

DETAILS:

Peter HENNESSY, 2002, *The secret state: Whitehall and the Cold War*. Allen Lane the Penguin Press: xxi + 234pp [ISBN 0-713-99626-9] [London: Whitehall bunker Pindar / Wiltshire bunker at Corsham].

Peter HENNESSY, 2007, *Cabinets and the bomb*. OUP / *British Academy Occasional Paper* 11: xi + 356pp [ISBN 978-0-19-726422-5] [On sale at £19.95 at the Parliamentary Bookshop, 17 Bridge Street, Parliament Square, SW1A 2JX. 020-7219-2890 bookshop@parliament.uk].

CROSSRAIL, LONDON

Two doubtless important volumes, neither of them light reading, have been published recently in connection with the Crossrail scheme.

DEPARTMENT FOR TRANSPORT, 2007, *Further responses to the Government's consultation on the Crossrail Bill Environmental Statement*. Department for Transport Cm 7249: 186pp [ISBN 978-0-10-172492-0].

DEPARTMENT FOR TRANSPORT, 2007, *Government overview of the case for Crossrail and its environmental impacts*. Department for Transport Cm 7250: 144pp [ISBN 978-0-10-172502-6].

CAVES & TUNNELS IN SOUTHEAST ENGLAND – PART 18

Publication of the 18th issue of the long-running series *Caves & Tunnels in South East England*, issued as Volume 34 of the *Records of the Chelsea Speleological Society* is imminent. Copies may be had for £5 each inclusive of postage and packing (payable to Chelsea Speleological Society) from John Cooper, Records Officer CSS, 31 Elm Close, WELLS, Somerset BA5 1LZ, who will also send (if asked) a list of earlier volumes (volumes 3 – 34 are all kept in print and are all still available) and their prices. All volumes, with the exception of caving titles listed below, catalogue underground sites of all kinds and dates in and around SE England.

The exceptions are volume 19 (1992) *Exploration Journal of Llangattwg Mountain*, 21 (1992) *Caves of Sveningdal (Norway)*, 25 (1999) *Caves of marble*, 28 (2004) *Exploring Welsh caves 1994/95*, 29 (2004) *Cave conservation*, 30 (2004) *Exploring Welsh caves 1995/96*, and 33 (2006) *CSS 50th Anniversary Journal*. The contents of what were retrospectively deemed to be Volumes 1 – 2 (1956 and 1958) in the series, published by the former London Speleological Group, were reprinted in various volumes as appropriate from 3 (1963) onwards.

TUNNELS, TOWERS & TEMPLES: LONDON'S 100 STRANGEST PLACES

Not so much a coffee-table book (the illustrations are all in black-and-white), but maybe a pot-boiler? With only a hundred sites featured, there are of course few tunnels alongside the (more numerous) towers and temples and miscellanea. David Lloyd is a 'writer and journalist' with over 20 years' experience. His latest volume is, he states, 'as much for the inquisitive armchair traveller as for the well-informed London resident, for the first-time traveller, or regular visitor.'

The 100 selected sites are each featured with a single page of text and a facing full-page plate. Those of most immediate interest to Subterranea Britannica members are the Abbey Mills sewage pumping station, the London Hydraulic Power Company, the never-opened Bull & Bush (or North End) tube station, the Camden Catacombs, King William Street Station and the disused City & South London Railway's tunnels, the Greenwich foot tunnel, the Holborn-Kingsway subway or tram tunnel, and the Wapping LU Station from which (when it reopens) a view along the Brunels' Thames Tunnel can be enjoyed,

The book contains a three-page bibliography, and a two-page index.

DETAILS: David LONG, 2007, *Tunnels, towers & temples: London's 100 strangest places*. Stroud: Sutton Publishing Ltd: (4) + 230pp [ISBN 978-0-7509-4509-7] [£19.99].

PARIS SOUTERRAIN – BELOW PARIS

Emmanuel Gaffard, who will be remembered by older members as an attendee at our International Conference hosted by Subterranea Britannica at Bath and contributor to our *Bulletin*, has produced a small but comprehensive volume of his coloured photographs of scenes below the Paris streets. Each of the numerous photographs has a caption in French and English. Apart from the classes of underground site indicated by the cover title, there are views of reservoirs, water-tunnels, cellars, wartime shelters, cable tunnels and the metro. Antiquarian to modern sites are featured.

The volume is a more accessible (in size, price and language) précis of the definitive Atlas du Paris Souterrain published in 2000. Amongst the acknowledgements, good friends of Subterranea Britannica Gilles Thomas and Julian Pepinster are credited. Small criticisms are the occasional use of US spellings in the text and the lack of diagrams or maps which are a strong feature of the 'parent' volume. Many of the sites have been visited by Sub Brit on our trips to Paris in 2004 and 2008 but there are still others to tempt us back.

DETAILS: Emmanuel GAFFARD, 2007, *Paris souterrain: carrières, catacombes, cryptes, égouts, tunnels .. / Beneath Paris: quarries, catacombs, crypts, sewers, tunnels ..* Paris: Parigramme: 176pp [ISBN 978-2-84096-482-7] [12€].

News - Publications - Periodicals

RAILWAY AND CANAL HISTORICAL SOCIETY JOURNAL 35(9) (NOVEMBER 2007)

Part 9 of volume 35 of the Railway and Canal Historical Society's journal contains of subterranean interest:

Paul LUTER, 2007, The Ketley Canal. *Jl. Railway and Canal Historical Society* 35(9)(199), 656 – 661

[Shropshire: near Wellington: a 3,916 yards tub-boat canal made 1787 – 88 to serve coal and ironstone mines and associated industrial installations / includes the 60-yard Potters Bank tunnel and 'a short tunnel at the foot of the incline' (under a road)].

Miles MACNAIR, 2007, The patents of W. and W.H. James. 8. Patent No. 9473 (1842): Elevated and pneumatic underground railways. *Jl. Railway and Canal Historical Society* 35(9)(199), 682 – 683.

RAILWAY AND CANAL HISTORICAL SOCIETY JOURNAL 35(10) (DECEMBER 2007)

Part 10 of volume 35 of the Railway and Canal Historical Society's journal contains of subterranean interest:

Carl SHILLITO, 2007, 'The Fiery Jack': a short history of the Spital Hill tunnel, Sheffield. *Jl. Railway and Canal Historical Society* 35(10)(200), 774 – 779.

[A steeply graded 370-yard tunnel made in 1846 to link the lines of the Great Central and Midland Railways. It

was partly bored, and partly cut-and-cover, and was partly unroofed reducing the length to 301 yards; closed by 1947 and both portals are now blocked].

P.A.L. VINE, 2007, Hardham canal tunnel. *Jl. Railway and Canal Historical Society* 35(10)(200), 747 – 749.

[A 375-yard tunnel in West Sussex to divert the navigable river Arun, saving some three miles, made between 1785 and 1790; it was closed to traffic in 1889 and blocked in 1898 by the London, Brighton & South Coast Railway whose lines pass over the top].

WEALDEN CAVE AND MINE SOCIETY: *CAVE AND QUARRY* 5 (2008)

The Wealden Cave & Mine Society, based in Surrey and Sussex, have published to date five issues of *Cave & Quarry*, in 1992, 1993, 1994, 1997, and now (at last!) in 2008. The latest issue contains papers, some of which have previously been published elsewhere, compiled and submitted during the years 2003 – 2007, as follows:

Andy BELCHER, 2008, The Bedlams secret. *Cave & Quarry* 5, page 17 [Dated 2005]

Andy BELCHER, 2008, The forgotten Jolliffe. *Cave & Quarry* 5, 47 - 48 [Dated 2007]

Andy BELCHER, 2008, A geological train of thought. *Cave & Quarry* 5, 35 - 37 [Dated 2004]

Peter M. BURGESS, 2008, Barons' Cave: possible evidence of castle structures. *Cave & Quarry* 5, 45 - 46 [Dated 2007]

Peter M. BURGESS, 2008, Barons' Cave, a wine cellar? – a new hypothesis. *Cave & Quarry* 5, 2 – 4 [Dated 2006]

Peter M. BURGESS, 2008, Chaldon's 'hearth-stone' quarry. *Cave & Quarry* 5, 7 – 9 [Dated 2006]

Peter M. BURGESS, 2008, Early use of Arabic numerals in Chaldon quarries. *Cave & Quarry* 5, 5 - 6 [Dated 2006]

Peter M. BURGESS, 2008, Efflorescent deposits in Barons' Cave, Reigate. *Cave & Quarry* 5, 43 - 44 [Dated 2007]

Peter M. BURGESS, 2008, Fresh thoughts on the use of plate rails in the Godstone Quarries. *Cave & Quarry* 5, 18 - 19 [Dated 2006]

Peter M. BURGESS, 2008, Merstham excavations. *Cave & Quarry* 5, 23 – 25 [Dated 2005]

Peter M. BURGESS, 2008, The mystery of the Bletchingley miners, 1841. *Cave & Quarry* 5, page 31 [Dated 2004]

Peter M. BURGESS, 2008, Ritual protection marks in Chaldon quarries. *Cave & Quarry* 5, page 10 [Dated 2006]

Peter M. BURGESS, 2008, Upper Greensand workings at Merstham after Jolliffe and Banks. *Cave & Quarry* 5, 13 – 16 [Dated 2005]

Paul W. SOWAN, 2008, Accidents Brockham: the General Register. *Cave & Quarry* 5, 28 - 30 [Dated 2005]

Paul W. SOWAN, 2008, Accidents at the Brockham hearthstone mine and limeworks, 1910 - 1934. *Cave & Quarry* 5, 26 - 27 [Dated 2005]

Paul W. SOWAN, 2008, The glass-sand industry at Reigate, Surrey. *Cave & Quarry* 5, 32 - 34 [Dated 2003]

Paul W. SOWAN, 2008, Reigate stone at Maldon, Essex. *Cave & Quarry* 5, 11 – 12 [Dated 2003]

Paul W. SOWAN, 2008, Reigate stone quarrying paper – a review. *Cave & Quarry* 5, 41 - 42 [Dated 2003]

Paul W. SOWAN, 2008, Re-opening Tower Wood stone quarry. *Cave & Quarry* 5, 20 - 22 [Dated 2005]

Paul W. SOWAN, 2008, What exactly is hearthstone? *Cave & Quarry* 5, 38 - 40 [Dated 2004]

DETAILS: *Cave & Quarry* 5 (2008) can be purchased for £ 5 (p/p extra) from the Wealden Cave & Mine Society, 8 Trotton Close, Maidenbower, CRAWLEY, West Sussex, RH10 7JP.

News - Miscellaneous

MAYOR OF LONDON TO BRING LOST RIVERS TO THE SURFACE

Rivers lost decades ago under tons of concrete could be brought back to the surface as part of a plan to revitalise London. Advisers to Boris Johnson are looking to create more open spaces and water features by uncovering parts of the tributaries which flow into the Thames. The Wandle, which flows from Croydon to Wandsworth, the Bourne in southeast London and the Brent, which passes through Wembley, are among the 16 'lost' waterways the Mayor wants to bring back to the surface. The scheme will start in the suburbs but will include "ornamental stretches" of inner London rivers if possible.

SOURCE: *Evening Standard* 16.6.2008.

PROPOSAL TO BRING THE RIVER TYBURN TO THE SURFACE

London property developer James Bowdridge has drawn up a plan to bring the River Tyburn, one of London's lost rivers back to the surface. The Tyburn is still flowing but now runs several metres underground. Mr Bowdridge is honorary secretary of the Tyburn Angling Society, a body which does not get to do much fishing in its river of choice, since the Tyburn was diverted underground to allow Mayfair to be built in the 18th century. Boosted by Mayor Boris Johnson's scheme to uncover lost rivers, he has commissioned architect's drawings to show what the West End would look like with a river flowing through it.

He admitted the scheme did involve slight difficulties; namely, the destruction of several billion pounds worth of property. Buckingham Palace would probably have to go and so would the House of Commons, as well as other chunks of prime West End real estate. The Tyburn runs from South Hampstead, through Regent's Park, along

Marylebone Lane, across Oxford Street, through Mayfair and under Buckingham Palace before flowing into the Thames at Pimlico, west of Vauxhall Bridge where its outfall into the Thames can be clearly seen..

SOURCE: *Evening Standard* 8.7.2008.

SECRET CHAMBER MAY SOLVE MEXICAN PYRAMID MYSTERY

Archaeologists are to open a long-sealed cave under a Mexican pyramid in the hope that it will unlock the mystery of one of ancient civilisation's greatest cities. With its soaring stone pyramids and geometric temples, Teotihuacan was once the biggest city in the Americas and possibly the world. However, experts have never been able to say with certainty who built it and why it was suddenly abandoned. An international team of experts believes the answer may lie under the Pyramid of the Sun, the centre-point of the vast ruined city 25 miles outside Mexico City. At the end of July 2008 they are to investigate a man-made tunnel and cave system underneath the pyramid – the third biggest in the world – to test theories that it was used for rituals including human sacrifice.

At its zenith between 150 AD and 450 AD, Teotihuacan was home to up to 200,000 people of various ethnic origins and thought to have been larger than any European city at the time, including Rome. But, sometime in the 7th or 8th century, it was set ablaze – possibly as the result of an insurrection – and abandoned. The Aztecs believed the city was divine and identified it with the place where the sun was created. They also gave it its name, which roughly translates as ''The place where men became gods.'' The tunnel entrance was discovered by accident in 1971 while workmen were installing a sound and light show for the 738 ft wide pyramid. After initial tests, it was dismissed as a natural cave and sealed two years later. Much of the information about it was lost when the archaeologist who found it died.

SOURCE: *Daily Telegraph* 14.7.2008.

DEATH OF PHILIPPE TRUTTMAN

Philippe Truttman died, aged 73, early in December 2007. He was the author of a massive and profusely illustrated monograph on the Maginot Line, published in 1985.

TRUTTMANN, Philippe [c. 1924 – 2007], 1985, *La muraille de France, ou la ligne Maginot*. Thionville: Gérard Klopp: 627 pp.

TRUTTMANN, Philippe, 2008, Obituary. *Casemate [Fortress Study Group]* 82, page 5.

DEATH OF BERTRAM ARTHUR JAMES – STALAGLUFT III TUNNELLER, ZAGAN, POLAND

Bertram Arthur James (1915 – 2008), a former RAF pilot, died on 18 January 2008. He was shot down south of Rotterdam in June 1940, a few weeks after German forces had invaded Belgium, the Netherlands and France, and spent almost five years in prisoner-of-war camps, making during this time something like a dozen escape attempts, several of them by tunnelling.

At Stalag Luft I, on the Baltic coast, he was party to a tunnelling attempt, although this was discovered before an escape could be made. He was more successful in getting out via a new tunnel in September 1941, but recaptured. After several more attempts, he was transferred to Stalag Luft III at Sagan in Silesia (now Polish Zagan) where in January 1944 he joined in further tunnelling schemes, including the driving of tunnels code-named Tom, Dick, and Harry, for what became known as 'The Great Escape'. Harry, at 120 yards, was to have been used by 200 escapers during the night of 2nd March 1944, of whom 76 got out before the alarm was raised. James was allocated the 39th place out of the 200. Three men (two Norwegian and a Dutchman) got away, the remainder of the 76 being recaptured, and 50 of them shot on the orders of Hitler.

James was then sent to Sachsenhausen, where he was interrogated under torture, but nevertheless with five comrades tunnelled out again, remaining at large for 14 days. He was eventually transferred to another PoW camp in the Tyrol, where the inmates were liberated by the US Army on 3 May 1945.

SOURCE: Dan van der VAT, 2008, Squadron Leader 'Jimmy' James. *The Guardian*, 22 January 2008, page 32.

CHANGES TO THE WATER SUPPLY ARRANGEMENTS, GIBRALTAR

Until recent years, much of Gibraltar's water supply was derived from large expanses of corrugated iron sheeting on the steep eastern side of the Rock, designed to catch rainwater and channel it into underground storage reservoirs. The installation of a desalination plant has rendered at least the iron sheeting catchment part of the system, installed by the Ministry of Defence and the Government of Gibraltar between 1903 and 1926, redundant. The sheeting was installed to a height of up to 250m on a steep (34°) slope of loose sand and rocks, and has given rise to problems such as loose sheets of corrugated iron being blown about, and sand slipping down onto properties on the coast road below. The civil government part of the sheeting was removed in the mid-1990s. The Ministry of Defence has now removed the remaining 13 hectares of corrugated iron sheeting, and steps have been taken to stabilise and revegetate the sand slopes and scree.

SOURCE: Mike COOPER, Paul STUBBS, Tony CARTER, and Stuart DUNN, 2008, Gibraltar runoff: a steep challenge for decommissioning. *Civil Engineering* 161, 35 – 41.

40,000-YEAR OLD BEAR SKELETON FOUND IN SCOTTISH CAVE

A bear's skeleton believed to be up to 40,000 years old have been recovered from Scotland's longest cave, it has been revealed. The animal's remains have been brought to the surface after a 12-year operation to clear an entrance blocking where they lay. It was found in 1995 by cave divers exploring the two mile-long stream cave Uamh an Claonaite in the network of caves at Assynt in Sutherland. It took the cavers from the Grampian Speleological Group until the end of last year to unblock an old 100ft-deep entrance shaft and provide a dry way into the cave. The group removed the skeleton at the end of June using cases to protect the bones as they were carried through narrow passageways to the surface. It is thought the bear was washed into the cave at the end of the last Ice Age, making it at least 11,000 years old.

Animal remains in nearby caves date to more than 40,000 years ago, so the bear bones could be of similar age. Bears were hunted to extinction in Scotland about 1,000 years ago. The cavers recovered everything visible, including the skull, backbone, ribs, and most of the animal's long bones. They have been passed to National Museums Scotland, the national museum service, where they will be 'stabilised' and carbon dated to establish their age and whether they belonged to a brown or polar bear.

Scottish Natural Heritage (SNH) and Historic Scotland (HS) had to give their permission for the work to take place as the caves are designated as a national monument and a site of special scientific interest.

SOURCE: *Daily Telegraph.*

Health and Safety

YOUTH DROWNS TRAPPED IN CULVERT AT WITNEY, OXFORDSHIRE

An unfortunate accident occurred when three teenage boys were playing in floodwater in a field near Eastfield Road, Witney. One, Max Sullivan-Webb (17), fell face-down into the water and was washed by the current towards the grilled entrance to a culvert which was clearly inadequate to carry the water away. Despite the efforts of a second boy to rescue him, or at least to keep his head above water, he remained forced against the grill and drowned. Meanwhile a third boy had gone for help but, sadly, paramedics were unable to revive the victim.

SOURCE: Sam JONES, 2008, Flood drowns youth trapped in culvert. *The Guardian*, 5 June 2008, page 24.

URBAN EXPLORERS DIE IN A STORM DRAIN AT SYDNEY, AUSTRALIA

Three urban explorers who had entered the Kingsford storm drain at Sydney on 20 January 2008 had, perhaps, not checked the weather forecast. As a result of a downpour, they all ended up at the grating at the lower end of the drain, where one appears to have been thin and agile enough to escape through the iron bars. His trapped companions died.

SOURCE: ANON, 2008, The main drain. *Descent* 201, page 8.

MAN CHARGED AFTER CAVE RESCUE

A man who became trapped in a cave in the New South Wales Southern Highlands, prompting a large-scale rescue, has been charged over the incident.

Geoffrey McDonnell became trapped in May at Wombeyan Caves, after entering the cave alone to take photographs. The experienced caver became trapped by a rockslide and for more than 48 hours desperately struggled for freedom, digging and shouting for help.McDonnell, a diabetic, was unconscious when rescuers brought him to the surface two days later. Specialist cave rescuers, paramedics, police officers and support crew were involved in the tough operation to extricate the man from the cave.

Police have charged McDonnell with entering a cave without authority, risking the safety of a person in the park.

SOURCE: *Sydney Morning Herald* 24.6.2008.

MINE EXPLORER DIES IN EDINBURGH

A caver who was rescued after falling unconscious in a disused coal mine shaft near Edinburgh died later in hospital.

Fire-fighters were forced to abseil into the shaft after the man apparently became overcome by gas (or shortage of oxygen) in the mine at the Wisp in Newcraighall. They were called to the scene when his fellow caver alerted passers-by.

It is understood the man was overcome within seconds of beginning his descent and had passed out a short distance from the shaft entrance.

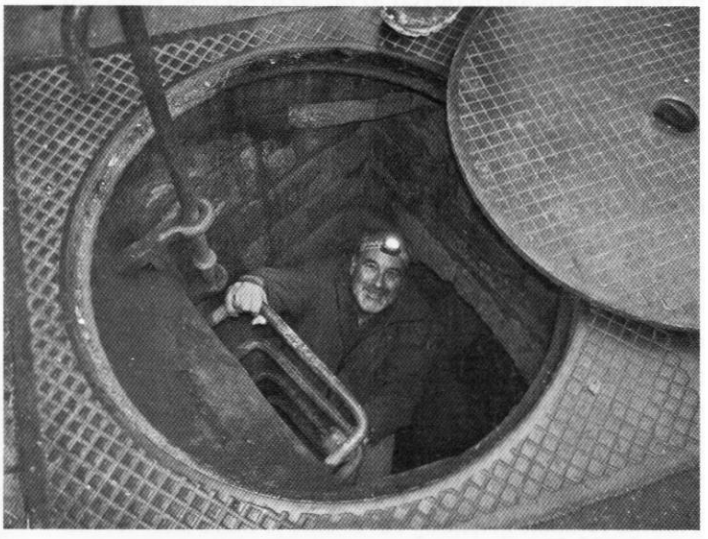
Lothian and Borders Fire Service arrived at the scene just before 8pm. A spokeswoman said specialist crew wearing breathing apparatus had to bring him to the surface to try to revive him. It is understood that the man, Peter Ireson, was a member of a local caving club and had considerable experience. He was taken to intensive care but sadly died a few days later.

The shaft is said to be one of several in the area. Though not sealed over, it was surrounded by a wall and partially-hidden undergrowth.

SOURCE: *Scotsman* 18.7.2008.

Who's Who in Sub Brit
Martin Dixon

Martin Dixon was elected as Subterranea Britannica's Chair at the Society's April AGM. He tells us how his interest in underground space developed and how he sees Sub Brit developing in the future.



My interest in underground space was sparked by a number of unconnected events in my youth. Born in Barnsley in the heart of the South Yorkshire coalfield, I was amazed by the number and size of spoil heaps (or muck stacks as they were locally known). If that was the volume of material being mined and thrown away, what volume of coal was being extracted and how much excavated space must there be down below? This fascination in large scale underground excavations was complemented by a more hands-on exploration of the WW2 air-raid shelters opposite the local Girls' High School. A particular and vivid catalyst in the study of 3D space beneath our feet was the model of the Victoria Line and associated underground services and tubes beneath Oxford Circus that used to be found in the Children's Gallery in the basement of the Science Museum. The model was subsequently transferred to the London Transport Museum and is now in their reserve collection at Acton.

This childhood interest lay dormant for a number of years, though punctuated by occasional family visits to the Blue John Caves at Castleton or to a working face at Houghton Main Colliery with the scouts. I also recall making a special trip to transit Woodhead Tunnel shortly before it closed to passenger trains in 1970. I moved to London in 1973 to study Chemistry at University College London. Here, if nothing else, I learnt that at degree level, Chemistry is Physics, Physics is Maths and Maths is impossible. I also developed an interest in the London Underground – it is quite scary writing this to realise the 'new' Piccadilly line stock is now 35 years old…

I spent thirty years working for British Airways from 1976 onwards. I worked across many departments including IT, Cargo, Sales and Customer Service. One of the most enjoyable jobs was four years spent in Newcastle, setting up an IT development centre that grew to 300 staff. I 'discovered' Subterranea Britannica in the late 1970s after visiting the High Elms Ice Well in Bromley with Linda Bartlett, my partner (and vice-chair of Sub Brit). On following up with some research in the local library I found correspondence with the society's founder, Sylvia Beamon; I was not alone!

For the ensuing 30 years Linda and I have been active in Subterranea Britannica, in particular attending and latterly arranging the Society's UK study weekends. Linda and I have also arranged Sub Brit weekends in France and Belgium over the last 10 years. We have both served on the Committee for a number of years and I authored the first Sub Brit handbook. Our other interests range far and wide. We have a share in a narrowboat ('*Dragonfly*', based in Cheshire), I fly as a private pilot and, partially thanks to British Airways retired staff concessions, we travel extensively round the world. We're also both keen archaeologists and long-distance walkers.

On taking early retirement from BA a couple of years ago it seemed an ideal opportunity to devote more time to supporting and steering Subterranea Britannica. This fitted well with Paul Sowan's desire to give up the Sub Brit Chair after many years.

As for the future of our society, I see a number of interleaved priorities:

* Continue to study a wide (and deep!) range of sites of all purposes (extractive, transport, defensive, storage, supply, protective, artistic, religious….) be they military or civil, ancient or modern. I'm particularly keen that we include unusual and at-risk sites in our studies.

* Encourage discussion and cooperation between members and with other bodies in the UK and worldwide. Continue to be a recognised authority on man-made and man-used underground space.

* Promote and arrange the safe and responsible exploration of sites, especially those not normally publicly accessible.

* Pursue the research, study and recording of sites. Publish this research using our own website, *Subterranea* and other publications.

During my own membership of Sub Brit, the Society has grown to almost a thousand members; the scope of sites studied has increased, as indeed has our geographic spread. I look forward to continued growth. I have made many friends for life through Sub Brit and hope and expect to make many more as the years go on.

Ty Croes Camp, Anglesey, North Wales

Mark Dalton

The War Years and 1950's

By-laws regulating the use of new anti–aircraft artillery ranges on the coast of Anglesey were drawn up and published in 1939. These ranges combined both land and sea areas at a remote headland accessed off the road between Aberffraw and Rhosneigr on the west coast of the island. The ranges and associated military infrastructure held a number of titles over the years but were known locally as Ty Croes Camp.Opening in 1941, the camp operated as a training ground for anti-aircraft gunners using the Vickers 3.7 inch AA weapon. Targets were provided primarily by the Anti-Aircraft Co-operation Units (AACU) based at nearby RAF Bodorgan, which had been built at the same time as Ty Croes. Initially a remotely controlled version of the Tiger Moth biplane, called the Queen Bee, was used for target work. Later, manned target-towing aircraft, such as the Henley, were also employed. Trials work commenced in earnest in 1943 and included trials on 40mm Light Anti Aircraft (LAA), 3.7 inch and 5.25 inch Heavy Anti Aircraft (HAA) weapons systems and their associated predictors and equipment. After the wartime peak, trials continued through the late 1940s and into the 1950s. By this time the facility was operating as "Trials Establishment, Royal Artillery, Ty Croes Camp".

AACU was now provided by RAE Llanbedr on the Cardiganshire coast following the closure of RAF Bodorgan soon after the war's end. The major projects during the latter half of the 1950s were the "Yellow Fever" radar-based fire control system for the 40mm LAA gun and the final development of the 3.7 inch gun in the form of the "Longhand" automated loading system. While these trials continued it was becoming clear that anti-aircraft guns would not be able to counter the threat of the new generation of jet bombers. Anti Aircraft Command was disbanded in 1955 and by 1958 the HAA weapons were considered to be obsolete. LAA weapons would continue in service for many years to come as local airfield defence but the time of the gun as a viable defence of the UK was over.

The Missile Era

The late 1950s and early 1960s were a period of transition at Ty Croes with the site being renamed "Trials Establishment (Guided Weapons), Royal Artillery". The last 3.7 inch AA guns were retired from the Army in 1959 and from then on anti-aircraft technology became focussed on guided surface to air weapons systems.

The original WWII camp had been set out in a roughly triangular pattern and included classrooms and domestic buildings. In order to upgrade the camp for guided weapons trials, the original camp was extended to the south with new buildings specific to missile training and handling being erected in these areas. A new series of emplacements were built for missile firing at the south of the site close to the coastline. A network of concrete roads was also constructed to link the various elements of the new facility. It is unclear if buildings to the west of the original site plus a rifle range and loop road to the north west were added at this time or were part of the original camp.

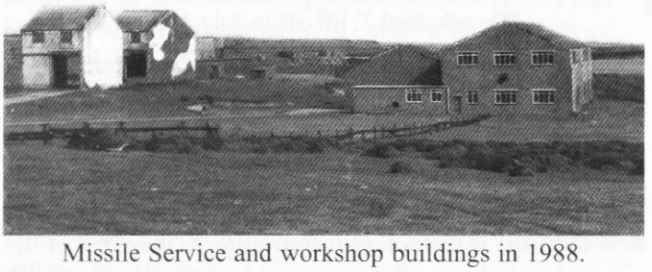
'Thunderbird 1' lift off in July 1961.
Photo from Keith Holderness

Following the initial upgrades, further buildings appear to have been added when required. These included a large workshop building at the southern extremity of the site. The domestic arrangements at the camp also appear to have been upgraded sometime postwar with approximately 15 houses being situated to the east of the main camp and a further 7 close to the main gate. Within the camp a cinema and NAAFI club (the 'Rocket'!) were available when duties allowed.

The primary Army guided weapon under development at this time was codenamed 'Red Shoes' and became known

One of 5 firing holdfast locations prior to demolition in 2006. Photo by Gwynedd Archaeological Trust

in service as 'Thunderbird'. This was a fully mobile anti-aircraft missile; Thunderbird 1 was in service from 1959 to 1966, with Thunderbird II lasting until 1977. During the 1960s and 1970s 36 Heavy Air Defence Regiment deployed to Ty Croes to live-fire their Thunderbird missiles. Trials work also continued at Ty Croes and it is likely that some early Bloodhound trials were done here, although the main work was centred at the Aberporth ranges. Other systems believed to have been tested at Ty Croes include Rapier, Blowpipe, Petrel and Skua missiles plus a 105mm light artillery gun. Training stopped at the camp in the early 1970s and April 1973 has been given as the date of final official closure.



Missile Service and workshop buildings in 1988.
Photo by Roy Sloan

Despite the end of large-scale activity at the camp there appears to have been some more limited activity which continued through the remainder of the 1970s and 1980s. By the mid 1980s the only obvious manifestation of this was the use of a rifle range on the northwest coast, and the presence of the local Army Cadet Force which had the use of several huts outside the main perimeter of the camp. Aerial photos and maps from the late 1980s show that the majority of the southern area of the camp had by then been fenced off, with the missile emplacements and associated service buildings falling outside this boundary and apparently abandoned. While the main camp was effectively mothballed and the old missile areas left to rot, there was one last role for Ty Croes to play.

UK Air Defence Radar Site

Ty Croes Radar in 1992.
Photo from Air Defence Radar Museum, Neatishead

Radar compound in 1992.
Photo from Air Defence Radar Museum, Neatishead

Political necessity had resulted in the rapid closure of the RAF's radar facility at Bishop's Court in Northern Ireland in 1991. Ty Croes was identified as a suitable replacement location as it was still MoD owned; RAF Valley could support domestic arrangements, and the area of coverage would be similar to Bishop's Court.

With the above reasons in mind, Ty Croes once again became an important military asset in 1991 when an RAF Type 94 Plessey AR3D mobile radar was sited to the west of the original camp. The site was officially opened on May 14 1992 with the radar being operated by No.144 Signals Unit using a combination of existing buildings and the mobile trailer units of the radar system. The site itself was secured within a new razor wire-topped compound fence. The addition of six prefabricated 'Yarnold' pillboxes provided defensive positions. The radar itself was protected within a further smaller fenced area and was weather protected by encasing it within a large domed cover.

The site had a relatively short life and the increasing use of civilian air traffic radar to monitor military flying plus the financial pressures on an air force reducing in size resulted in the closure of the radar station in 1995.

Anglesey Racing circuit

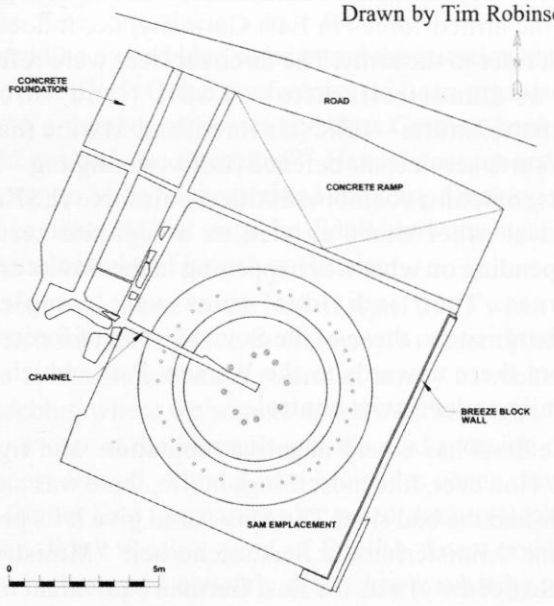
During the early '90s the main camp buildings were demolished to make way for a motorcycle racing circuit. Racing started in 1993 and significant upgrades in 1997 meant that the venue became more usable for larger bikes and also cars.

The initial site clearance removed the main camp and the housing to the east, plus the majority of the later, missile era, buildings. However, several areas still remained. The seven houses situated in a small MoD estate just outside the original main entrance were retained and eventually sold off into private ownership. The radar compound, rifle range and loop road to the northwest of the main site were retained. Various buildings, hard-standings and roads associated with the missile era on the southern periphery of the property also survived. The large workshop building situated at the extreme south of the site was reused as a 'Performance Driving School' and two other buildings in the same area were used as storage for the circuit.

The circuit itself followed the route of the old perimeter road with several of the corners, such as 'Radar', named to reflect the previous usage of the site. Access to the race track, now known as Anglesey Race Circuit or 'Trac Mon', was past the former MoD houses near the original entrance and then down a service road to park on the old drill square which had become the public car park.

The track operated in this configuration until 2006 and in this time became well known to motoring enthusiasts for track days and through TV media use for motoring programmes such as Channel 5's 'Fifth Gear'. Ambitious plans for improving the circuit originated in 2001 and came to fruition in 2006 when extensive redevelopment of the site commenced. This involved the complete remodelling of the main site with the existing circuit being demolished to be replaced by three interlinked circuits. Although further remnants of the former military site were to be demolished, this time a full archaeological survey was required by the planners prior to the work commencing.

Drawn by Tim Robinson



Gwynedd Archaeological Trust (GAT) conducted this on-site investigation in May 2006 and identified five missile emplacements, several buildings, a light railway and various other features during their survey. GAT also maintained a watching brief at the site during the large-scale excavations that followed and identified further features when topsoil was removed. By late 2006 extensive earthworks had removed the majority of the features identified and recorded by GAT. The last retained wartime workshop on the site of the old main camp was also demolished at this time.

On May 26 2007 Anglesey Circuit reopened with a much improved facility and with plans to upgrade the circuit further to a Formula 3 & World Superbike venue.

The site today

Currently the 'Performance Driving Centre' and the two associated storage buildings are still used by the circuit, although the future of at least one may be in doubt. The rifle range and loop road to the northwest are also still extant. The main area of interest today is the former radar compound which contains evidence of a number of different periods in Ty Croes's life.

The Radar Compound

The majority of the buildings within the compound are sited on rising ground to the west and are easily observed from the houses and racetrack. They appear to be of 1950s origin and are in the main comprised of offices and technical buildings. These are now being refurbished. Several are already in use by Premier First Aid Ltd as a 'Medical & Training Centre' and a further, smaller building is used by 'Kickstart Bike Training'. There is also a vehicle shed, a fuel storage bunker, a light railway and several smaller buildings which probably held plant equipment. Several concrete roads link the buildings and one road terminates at a large concrete hard-standing now divided by the compound fencing. The size of the hard-standing and the central conduit run would suggest this may have been a missile launch pad.

Evidence of the more recent radar station can also be seen. A large circular concrete slab was added near the termination point of the light railway to act as a base for the radar. Metal tie-down hoops for the radome are visible around this. There is also a good-condition concrete vehicle ramp with modern ancillary equipment situated in the northeast of the compound. The Yarnold defensive positions also remain with one being situated on top of what appears to be a holdfast for an earlier light AA gun.

The station headquarters building and a smaller building behind it appear to be reused 1950s buildings. A tarmac road with a white painted parking space and the letters 'OC' ends adjacent to these buildings. The buildings are badly damaged due to their vulnerable location on the reverse slope out of view from the main race track area.

Summary

Ty Croes Camp played a vital role in the war training AA gunners and was used in the development of many important weapons systems from wartime days, through the early Cold War period and into the 1970s. Its final role as a RAF air defence radar station saw out the last gasp of the Cold War and the site finally gave up its association with the military as a result of the shrinking UK defence budgets of the 1990s.

The site remained remarkably intact until the early 1990s and the small compound that still survives contains a fascinating snapshot of elements from each era of Ty Croes's history plus an insight into how existing structures were reused as dictated by necessity.

With thanks to:

John Roberts	Nina Steele	Roy Sloan
Nick Catford	Keith Ward	Doug Robb
Keith Holderness	Ed Dalton	2Blackcat

Armed Forces in East Germany

Mike Barton

Perhaps a few words on the 'armed forces' in East Germany, the former German Democratic Republic, might be in place for those of you who have only a passing knowledge of the situation in East Germany prior to reunification.

Basically, there were two elements: the Russian forces and the German forces. Let's take a brief look at the Soviets as they were in charge. 'Soviet', 'Russian' – we already have two terms. They are often used interchangeably, but some people do get upset (particularly, non-Russians!). 'Soviet' referred to things pertaining to the whole of the Soviet Union, i.e. the Soviet armed forces. 'Soviet' means 'council' in Russian and dates back to the 'workers' councils' which met to discuss 'democratically' (yes, I also believe in fairies) what action was to be taken post-revolution. So the Soviet Union was a union or collection of workers' councils (and pigs are taking flying lessons this week).

'Russian' refers to things in the largest republic in the USSR, i.e. the huge area around Moscow, with White Russia and the Ukraine to the west and southwest and Siberia lying to the east, plus the central Asiatic republics forming the soft underbelly of the USSR.

The Soviet forces in East Germany, or EGER as was used by relevant circles in the British Army, had several name changes in the period from post-WW2 to the final collapse of communism in Eastern Europe, ranging from Group of Soviet Occupational Forces in Germany to, finally, Western Group of Forces. To simplify matters I will refer to them as 'the Group'.

'Groups of forces' were only found outside of the Soviet Union. In Eastern Europe there were five Groups: Northern, Central and Southern Groups of Forces in Poland, Czechoslovakia and Hungary respectively, the Western Group in EGER and the three Baltic countries of Estonia, Latvia and Lithuania formed the Baltic Group of Forces. In wartime, a group would have formed a 'front', i.e. a front is a grouping of armies under a single command.

The Group in the EGER consisted of six armies, of which five were ground forces and the sixth was an air army [16th air army]. The five land armies [1st, 2nd, 3rd, 8th, and 20th] each had four to five divisions made up of motorized infantry and armoured units. In addition, there were the normal support services, such as engineers, supply, communications, transport, etc. A 'power' indicator: a tank division would have somewhat more than 11,000 personnel and some 300 tanks. Towards the end of the 80s, the Group was 350,000 strong. The Group of Soviet Forces in Germany was far and away the largest group of forces outside of the Soviet Union.

In addition to the Group there were two further interesting Soviet parties present in East Germany in significant numbers, i.e. the KGB and the GRU. The KGB represented the Soviet counter-intelligence and intelligence services of the Soviet Union and the GRU was Soviet military intelligence. Both of these services were directly subordinate to Moscow. Relations between the KGB, GRU and the Group were not always good.

On the East German side the 'armed organs' were made up of a wide range of uniformed bodies, ranging from the armed forces to armed factory groups. There is only space here to deal with the major components: the NVA, Stasi and border guards.

The NVA (Nationale Volksarmee) was the term given to the armed forces in East Germany, i.e. it does not just refer to the army. The three services were referred to as Landstreitkräfte – LaSK (land forces), Luftstreitkräfte – LSK (air force) and Marine (navy). A fourth service, air defence (Luftverteidigung – LV), was sometimes combined with the air force (LSK/LV) and at other times existed as a separate service, depending on what was happening in the Soviet armed forces. Their individual roles were completely subordinate to those of the Soviet Group of forces and from there upwards to the Warsaw Pact, which was totally under Soviet control.

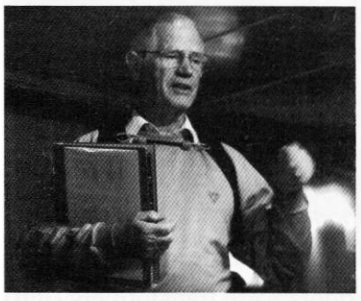
The Stasi has a very negative reputation and rightly so. However, like most things in life, there was a good side and the bad side! The Stasi, or to give it its proper name 'Ministerium für Staatssicherheit' (Ministry for State Security) was the East German equivalent of the KGB (on which it was closely modelled) and consisted of two main elements: the counter-intelligence side (Abwehr) – who were the guys who got the bad press and the HVA (Hauptverwaltung Aufklärung), which was the foreign intelligence service. Both the Abwehr and the HVA were organised into main departments and departments, each responsible for various aspects of their respective trades.

The Border Guards (Grenztruppe – GT) were at times directly subordinate to the NVA, at other times they formed a separate service. They were organized into three commands – northern, central and southern; these in turn were broken down into regiments and battalions, just like a normal army. The border guards were heavily armed and in the event of war, would have provided a significant addition to the fighting capability of East Germany and the Warsaw Pact.

Positively the last German tour!

Nick Catford

In 2000, Sub Brit member Mike Barton came over from his home in Germany to attend the Hack Green conference. Mike had lived in Germany since 1978 working as a civilian German translator but first went to Germany in 1960 as a regular soldier involved in Russian signals intelligence. Mike's approaching retirement had rekindled his interest in the military and political situation in East Germany during the cold war. With the cold war over and the Russians long gone it should now be possible to visit some of bunkers that had been left behind.



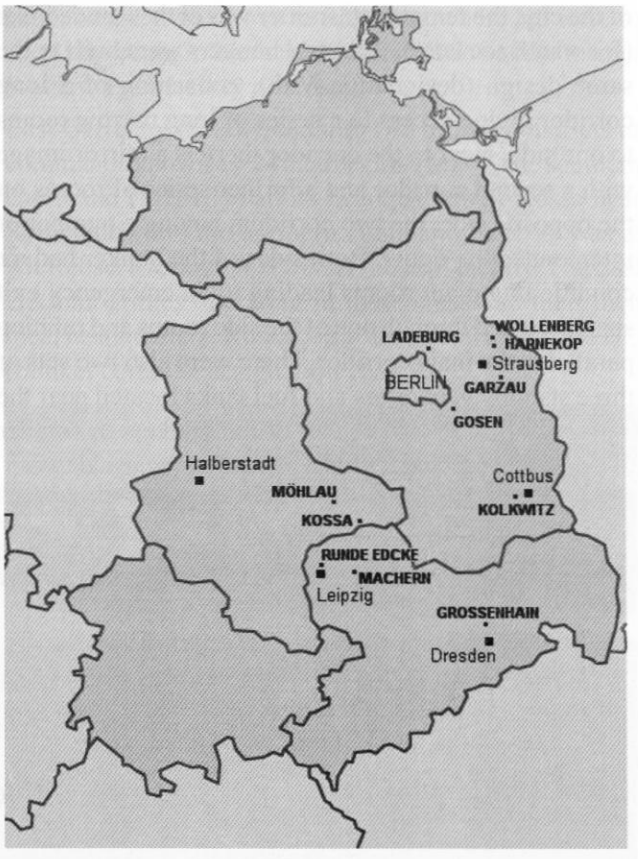
Our Führer. Photo by Mark Bennett

At the time, organising a tour for Sub Brit members seemed like a good idea so he posed the question at the end of the Hack Green conference "If I can organise a visit to a number of Soviet and East German bunkers would anybody be interested?" Hands went up across the room so Mike felt committed and started making the arrangements. At that stage, he didn't know the location of a single bunker, German or Russian.

The tour took place at the end of April 2001 when 20 Sub Brit members drove to Germany to meet up with Mike at the Bundeswehr (German army) barracks at Magdeburg where we were to spend out first night. We left our cars at the barracks and the next morning our transport arrived, a brand-new Mercedes coach driven by a former East German border guard, Jochen Becker. Jochen didn't speak a word of English, knew nothing about bunkers and certainly didn't know what he was letting himself in for; his brand-new coach didn't stay clean for long!

The ten-day tour took in some 18 bunkers at a variety of military and government sites and by the end of the tour we were all 'bunkered out'. When asked, shortly afterwards, if another tour could be arranged Mike was quick to say "Never again!" but he soon mellowed and the following year another similar tour of different sites was arranged and smaller tours have followed every year since.

In 2008 Robin Ware persuaded Mike to organise one final tour. Mike is now approaching 70 and is looking forward to a more peaceful retirement. Robin looked after the arrangements in England, while Mike arranged the sites, booked the hotels and organised the transport. Although Jochen Becker was unable to drive us, we were able to get his son, Andy, a former Bundeswehr special forces soldier. So everything was arranged and 16 members of



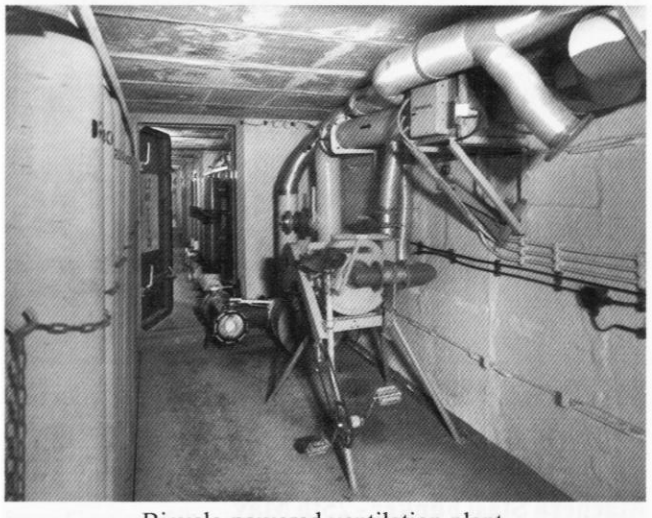
Sub Brit once again drove to East Germany to meet up with Mike and Andy for what was described as "positively the last German tour" until the next one of course!

Machern Stasi bunker - 25th May

The German Democratic Republic (GDR) was divided into 15 'Bezirk' or districts, each of which had its own 'mini-government' which included representatives from the Stasi (Staatssicherheit, or more correctly: Ministerium für Staatssicherheit - Ministry for State Security). The Stasi really came into force following the 1953 uprising in East Berlin and other German cities.

Telephone Exchange. Photo by Nick Catford

The Stasi HQ in each Bezirk had its own bunker facilities, including a remote transmitter, some distance from HQ bunker. The Leipzig bunker was at Machern, 15km east of the city, the remote transmitter was at the Runde Ecke (for which see later). All Stasi bunkers were built to the same design (designation V2b), consisting of a long corridor giving access to a series of long narrow rooms to one side. Next to the corridor there is a mirror image with a second corridor and a further series of rooms on the opposite side, the two corridors having a number of interconnecting doors. Both sides of the bunker had air conditioning plant rooms leading to an emergency exit shaft accessed through one of the side rooms and running parallel to the main corridor. There were also two sets of three standby generators and fuel tanks located near the entrance airlock. One or two of the bunkers in smaller districts had only one 'wing' instead of the usual two.



Bicycle-powered ventilation plant.

The bunker comprises pre-fabricated sections (up to 650 parts with a further 70 parts for the approach tunnel). The two entrances are generally located within a shed or storage facility to conceal them. These buildings can also be used to store spare parts, etc. Similar bunkers were also used at other non-Stasi locations and the first bunker of this type was actually built in Wandlitz in 1968 for the bodyguards of the SED (GDR communist party) members who lived in the village.

To ensure that as few people as possible knew of the existence of the bunker each site was provided with a 'cover story': at Machern local residents were told that the site was holiday chalets for waterworks employees. As there were already such chalets in the vicinity this would have been believed by most people; every effort was made to conceal the true function of the site. The diesel exhausts were positioned near a chalet chimney to deceive thermal imaging, a radio receiving aerial was built to resemble a tree within a wooded area and screens were erected to obscure more obvious features.

The site was guarded by dogs and the entrance building itself had a steel cable fixed to the front and rear walls for dog runs. The bunker was built between 1969 and 1972 and had a staff of between 85 and 120 of which five were women for cooking and cleaning. In the event of war, three KGB advisers would have been sent to Machern although in fact no Russians ever went to the site. fifteen of the bunker personnel were technicians, the remainder Stasi operations personnel.

We entered the bunker, turned into the initial airlock, then into the main airlock which brought us into the two parallel corridors running through the facility separated only by a thin wall with a couple of doorways. The long rooms left and right served as offices and dormitories or for technical and support purposes and included a communications room, encryption room, kitchen, medical centre and a workshop. There was also a section for the KGB representatives and another for the local Stasi head.

At the far end of the corridors were transformers (left) and toilets (right) and two isolated corridors (extreme left and right) which were used for ventilation and filtration plant. These could be driven by fixed wheel-less bicycle in the event of a power failure. At the end of the two ventilation tunnels there were emergency exit shafts reached through further airlocks.

Water was normally provided from an external deep well. The diesel generators were located between the entrance airlocks; the fuel tanks in an adjacent passage contained up to 10,000 litres of fuel which was sufficient for maximum of 35 days, although there were only stored food rations for 6 – 14 days. The remote radio site was located some 2 km away and was connected by landline with the bunker. The bunker would normally only have operated in receive mode until war broke out.

Two standard design Stasi bunkers have been restored as museums; the other at Suhl was visited on the 2001 tour. Machern is the better of the two bunker museums and although it was largely stripped when the Stasi left it has now been almost fully re-equipped and restored. The bunker is open on the last weekend of the month from 13.00 – 16.00 and admission costs 3 Euros. The bunker is run by the Citizens Committee Leipzig Association which also administers the memorial museum at the Runde Ecke which was to be our next port of call.

Runde Ecke – 25 May

The Runde Ecke (Round Corner) was the name given to the Stasi HQ for the Leipzig Bezirk and was so named because it was a round-fronted building located at the junction (corner) of Dittrichring and Goerdelerring . The building now houses a memorial museum on one side of the ground floor. Although everybody in Leipzig knew what the building was, it wasn't shown on any DDR-era maps of the city. It was in this building that officers of the Stasi worked on their surveillance of the citizens of Leipzig, checking post, tapping phones, poring over photos or reading people's letters.

When the protests began in Leipzig in 1989 that would eventually lead to the collapse of the East German state,

External view of the Stasi headquarters in Leipzig.

the 'Runde Ecke' was an obvious focal point and one of the famous banners of the time states 'When will there be a Museum here?' it now hangs proudly above the boards that document the former inhabitants' work. In 1989 there were 2,400 Stasi personnel in Leipzig and when the demonstration started 30,000 anti-communist protesters were expected. In the event 75,000 people turned up and the Runde Ecke was seized without a shot being fired. The demonstration in Leipzig quickly spread throughout the DDR, eventually leading to the fall of the Berlin Wall and the reunification of Germany. The peaceful demonstrations in Leipzig in 1989 and their progress take up one section of the exhibition.

Elsewhere, the exhibition covers how young people were trained in the Ministry, the use of sport in the DDR to further the ideology of the state and surveillance techniques. Various artefacts from the offices that were found when the Stasi abandoned the building are on display as are numerous photos, letters and memos taken from the Stasi files. Most of the rooms contain display cabinets or wall boards with photographs and documents but two rooms have been retained with their original (or recreated) furniture and fittings; one is an office and the other is a small holding cell. One of the most depressing documents refers to the reporting of a fifteen-year-old boy by his teachers for something he wrote in class; two years later that 'black mark' was causing him trouble with job and education applications.

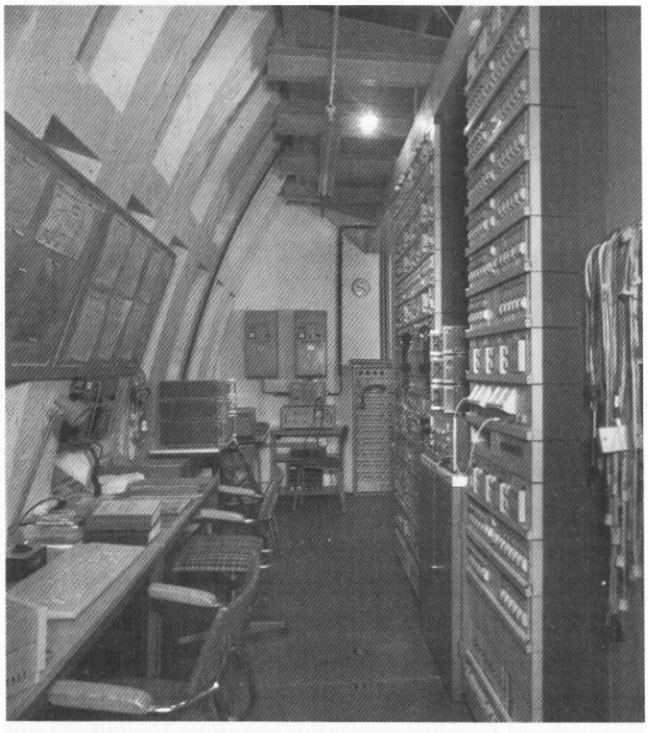
Although all the interpretation panels are in German we had an English-speaking guide with a good command of the language; she was able to tell us a lot of information about the function of the building although she appeared to know little more about the site than her pre-learnt script.

The Runde Ecke is open daily from 10.00 – 1800. Admission is free but there is a charge of 3¸ for a guided tour (minimum of 5 people). On one day of the year other parts of the building are also opened to the public on Leipzig's equivalent of our 'Open House' weekend. On this day, the basement is open and visitors are able to see a large telephone exchange; our guide told us that she has only been to the basement once and got lost!

Kossa 25/26 May

From Leipzig, we drove to Söllichau where we were to spend the night in barrack accommodation at the former Warsaw Pact facility of Kossa.

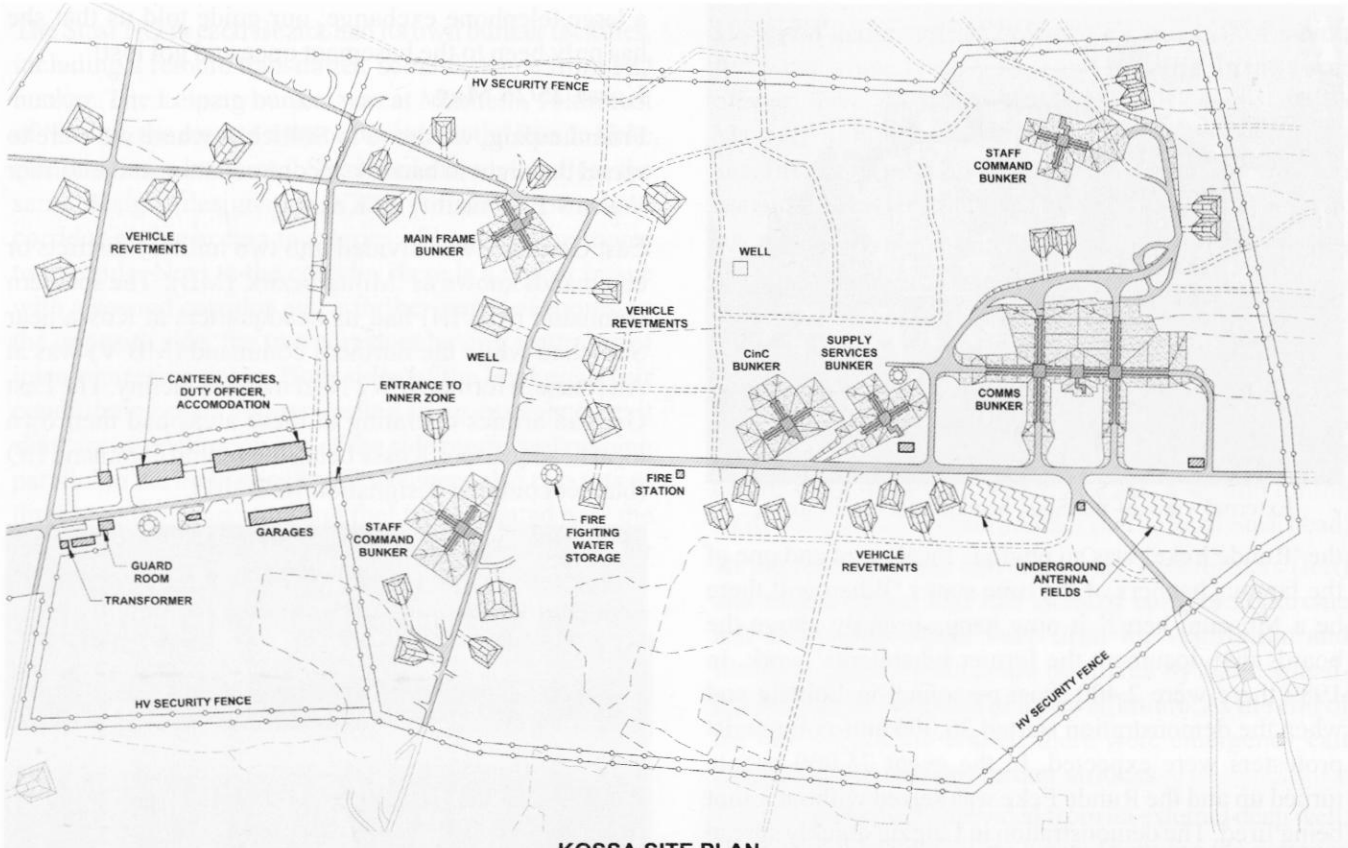
East Germany was divided into two military districts or commands known as 'Militärbezirk' (MB). The southern command (MB III) had its headquarters at Kossa near Söllichau while the northern command (MB V) was at Alt Rehse, a former WW2 Nazi medical facility. The East German armies operating in these areas had their own local headquarters, Kossa being the central command HQ (bunker complex designation 16/7/301).



The telephone exchange in the communications centre.

The site has a long history dating back to 1935 when an armaments factory was built in 400 hectares of forest at Söllichau. Its buildings were largely blown up by 1951 by the Red Army in accordance with the Potsdam Agreements. In the 1950's, the Volkspolizei (GDR National Police), later the NVA (Nationale Volksarmee – East German Armed Forces), started to use the site. From 1958 onwards, workshops, an equipment depot and accommodation appeared. These units vacated the site by 1979 and Kossa gradually developed into the bunker complex seen today.

The complex is spread over an area of approximately 397 hectares. Some 350 personnel would have been stationed in Kossa with further personnel stationed in nearby Bad Düben; 240 operational personnel would have served in the bunkers, backed up by 85 logistical staff. There was food in store for three days and the bunkers could have been hermetically sealed for 6 hours. The



KOSSA SITE PLAN

Drawn by Tim Robinson

bunkered garages would have housed some 24 communications vehicles which were connected to the bunker communications system until departure. Four complexes of this type were built - two each for the territorial commands and two for their respective armies. The Kossa site would have been the territorial command HQ for the 3rd Army in Mosel.

Apart from ancillary facilities, there are six main bunkers designated BW (Bauwerk) I – VI. The key element at the site is the communications bunker (BW V) with its six wings for housing the communications vehicles. At the heart of the bunker is the communications centre itself with its racks of radio equipment and a telephone exchange. Four bunkers (BW I - IV) were for staff officers; each had 50 workplaces and would have been used by NVA and Soviet general staff officers, one had a mainframe computer. The equipment Bunker (BW VI) completed the complex; this served the whole facility and included a 400 kVA diesel-generator in the event of a mains supply failure. The total power consumption was, on average, 520 MWh. A total of 36 vehicle revetments were also located in the woods around the site and an on-site fire station was located close to the comms bunker.

The site has several large underground aerial fields; each antenna was comb-shaped and occupied the area of a small football pitch. The actual transmitter sites were located some 10 - 12 km away and were connected by cable to the Kossa complex; this aided security as no radio masts were visible from the air. In addition, there was an over-flight ban even for Soviet and East German military aircraft.

The facility was built between 1976 and 1979 by NVA construction engineers. The bunkers provided biological and chemical protection, but would not have provided any substantial protection against a nuclear strike. The site was used occasionally during Warsaw Pact and major NVA exercises. Construction costs were some DM 100 million, (about £40 million) for material alone. In contrast to the northern bunker at Alt Rehse, Kossa had strategic importance since a computer complex was installed for use by the general staff of the Warsaw Pact.

As you enter the gates at the west end passing through the high-voltage fence that surrounds the site, the road leads into the U-Zone ('Unterkunftszone' = Accommodation area). Close to the gate there are two long buildings: on the left for sleeping accommodation for the site guards and offices for daily administration of the base. From here, access is controlled to the P-Zone (Parkzone = Bunker area) 100 metres to the east. Personnel entering the inner zone had to key in a number and their codename, which was checked by the duty officer. Opposite the administration buildings there is a large range of garages for the guards' vehicles.

The bunkers are constructed of 40 cm thick reinforced concrete arc segments. They are covered with a 2cm thick plastic layer which, in turn, is covered by two layers of loose brickwork; the whole structure is then covered by 2m of earth. Two thirds of the bunker height is

One of the bunkerd garages for housing comms vehicles.

underground, the top third forming a small mound; the total height is 10m. Although the bunkers would not have withstood a nuclear strike, they were capable of moving laterally up to 20cm in each direction.

In 1997 Kossa was recognised as a cultural monument and an association was set up to turn the complex into a museum under the leadership of Dietrich Krumnow, the last commandant from 1984 - 1990. It was thanks to his huge personal effort that the site was maintained and developed as a museum. The museum opened on 24 May 2002. Sadly Dietrich Krumnow died at his desk in August 2006, 'on duty' to the very end.

Although we arrived late in the day, our tour of the site started on arrival with the main communications bunker which has been fully restored. All the rooms within the bunker have been re-equipped and several of the wings have an impressive array of NVA communications vehicles, I think a number of our party could have gladly spent more time in the bunker looking at the vehicles. Our guide was very knowledgeable but for those who preferred to 'do their own thing' there was ample opportunity to wander round at will looking at the impressively restored rooms and vehicles and to take photographs.

We returned to the barracks for an outdoor 'pea supper' before lighting a log fire as the sun went down after which copious amounts of alcohol were consumed before retiring to our respective barrack rooms. Our group was divided into snorers and non-snorers but it was soon obvious that a number of our members had lied! After breakfast, we went back into the 'P-Zone' to look at the other five bunkers in the complex; they have all been equally well restored apart from one of the staff command bunkers which has been turned into a museum with exhibits, display boards, photographs etc.

Despite its isolated location at the end of a long twisting road several kilometres northeast of Söllichau, Kossa is one of the best bunker museums I have seen. The museum is open Tuesday – Sunday with tours lasting two hours at 10.00 and 13.00. Admission is 10 euros. Our thanks are due in particular to the staff there who opened the complex on Monday so that our programme did not have to be altered.

Grossenhain 27 May

There was only one site on our programme for the following day, the former Soviet Air Force Base at Grossenhain, 30 km north west of Dresden.

The airfield at Grossenhain was built between 1913/1914 as a Prussian Military Airfield and was home to the Royal Prussian Flying Corps Flieger-Bataillon Nr.1. The first hanger was completed on March 15th 1914 and the airfield was operational the following day. Military flying schools were established at the airfield between 1915 – 1918, training a large number of pilots and observers; one of the pupils was Manfred von Richthofen, the German fighter pilot known as 'The Red Baron'.

One of the Granit nuclear storage bunkers.

Following the Treaty of Versailles in June 1919 which ended WW1, most of the buildings on the airfield were demolished. The airfield took on a civilian role with a Flying Association operating there in the 1920s and 30s but gradually it returned to military use after the National Socialist ('Nazi') Party came to power in 1933. A remote reconnaissance squadron was stationed there from 1934 and pilots from Grossenhain participated in the Spanish Civil War. During WW2, the Immelmann squadron of Ju 87 Stuka dive bombers was stationed at Grossenhain. Towards the end of the war in April 1945 the airfield was occupied by the Red Army and Grossenhain was developed as a garrison town. During WW2 the length of the runway had been 1,375 metres but this was lengthened during the 50s and 60s, and forty Hardened Aircraft Shelters (Type GDF-2A/13) were built at dispersed sites around the airfield.

The runway was further extended to 2,400 metres and the airfield enlarged in 1983/4 and the airfield was given the code name 'Ararat'. The airfield also took on a nuclear role with the construction of two 'Granit' bunkers for the temporary storage of nuclear weapons, 'Granit' being the Russian codeword for this type of bunker design.

Following the end of the cold war, the local population were able to visit the airfield for the first time when it

was opened up to the public on 15/16 August 1992. On 22 March 1993 the Soviets started leaving Grossenhain and the withdrawal was completed in the middle of August that year when the airfield was handed back to the civil authority.

The airfield is still in use with commercial flights operated by Kilianair; the airfield is also home to a number of flying clubs and flying schools. In recent years the airfield has been developed as an Aero-Park attracting both aerospace-related and other companies. The development of the Aero-Park has led to the demolition of many of the buildings around the perimeter of the airfield. One large hanger dating from 1918 remains as do approximately half of the hardened aircraft shelters, some have now been put to commercial use while others remain empty. A number of interpretation boards have been placed around the airfield.

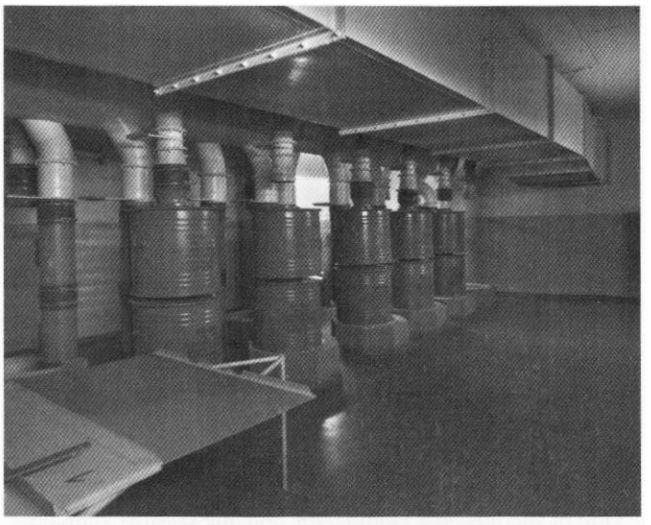
A restored but engineless Russian MIG-21 in one of the hardened aircraft shelters on the airfield.

In 2004, one of the Granit nuclear storage bunkers was opened as a museum telling the history of the airfield from 1913 to the present day. The museum has a model of the airfield showing all the buildings, many of which have now been demolished. The adjacent Granit bunker is used by local radio amateurs. After seeing the museum, we drove round the remaining structures on the airfield in the coach; the highlight was a Russian MIG-21 which is kept in one of the aircraft shelters, although sadly it doesn't have an engine.

After leaving Grossenhain we headed northeast towards Poland, but applied the brakes on the northern outskirts of Cottbus.

Kolkwitz 28 May

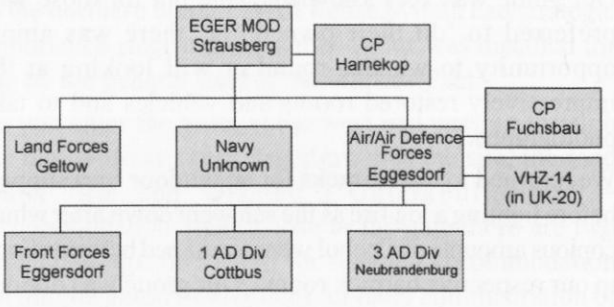
Kolkwitz is the former home to the 3rd Air Defence Division, responsible for the southern half of East Germany. The bunker, which was built between 1965 and 1967, has been partially restored to provide an insight into the air-defence concept of the country and as part of the overall Warsaw Pact air defence system. Kolkwitz lies just to the west of Cottbus in the southeast corner of the state of Brandenburg; the facility is therefore also sometimes known as Cottbus.



The filter room; similar Russian drum filters are found in many Russia, Stasi and NVA bunkers throughout East Germany.

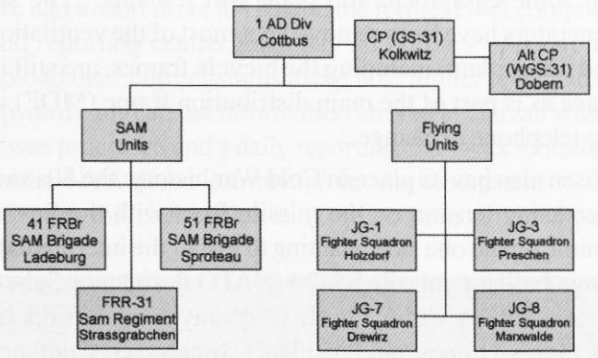
In line with the organization of the USSR armed forces, the East German armed forces (NVA) consisted of three services: Land Forces (LaSK), Navy (Marine) and Air/Air Defence Force (LSK/LV). At different times the Air/AD Force operated in the Warsaw Pact countries as a single service or as two separate services, depending on current military thinking. The two independent services were combined into one in May 1957 with its headquarters in Cottbus. In 1958, the HQ moved to Strausberg-Eggersdorf, just to the south of Strausberg, east of Berlin, the site of the EGER Ministry of Defence. In 1960, the Air/Air Defence Force took over 'Fuchsbau' in Furstenwalde as its main command post (ZGS-14).

By 1990, the LSK/LV numbered some 35,000 personnel, of whom 29,900 were in air defence and the SAM (Surface to Air Missile) units. The service operated in 132 facilities and had 21 airfields at its disposal. So the organisation chart looked as follows:



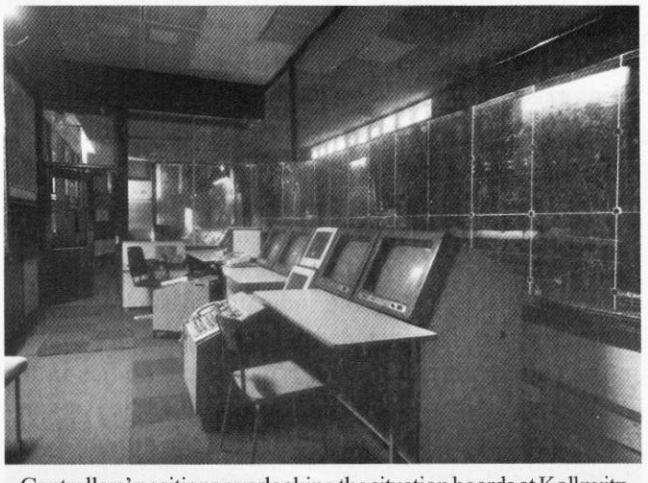
The 1st Air Defence Division in Kolkwitz was tasked with defending the southern air space of the GDR. It was established in 1956, underwent various name and organisational changes and finally acquired this title at the end of 1961. The division HQ was located in a barracks at the Cottbus airbase a few minutes away from its command post in Kolkwitz, officially designated GS-31. As in the 3rd AD Division, the 1st AD Division comprised flying personnel, SAM troops and radar troops, together with supporting personnel for communications, transport, etc.

The organisation of the 1st AD Division was as follows:



Although signposted, the museum is difficult to find in the middle of a small residential/industrial area. The three-level bunker lies beneath a single storey administration building and the surrounding grounds and the only evidence of it on the surface is a covered stairway descending into the ground in front of the main entrance into the admin block.

At the bottom of the stairs, the usual airlocks and decontamination suite open onto the main spine corridor on the upper level. Once the bunker was abandoned it was largely stripped of fixtures and fittings and most of the rooms on the upper level are still empty or have been filled with display material or artefacts not necessarily relevant to the bunker itself (in one room there is a section of high-voltage electric fence!).



Controllers' positions overlooking the situation boards at Kolkwitz

The air conditioning and filtration plant is located at the far end of the upper level with the usual bank of brown Russian drum filters found in most bunkers in East Germany. The middle floor is far more interesting with a large telephone exchange, sick bay and a very impressive operations room which still contains its original maps with the controllers' positions behind a glass panel to the rear of the room. The room is very atmospheric and gives a good impression of what the bunker must have looked like when in use. On the lower floor, the kitchen and canteen have been fully kitted out, there is another telephone exchange and adjacent battery room, but again many of the rooms on this lower level are empty and awaiting restoration.

The bunker is open on the third Saturday of every month from 9.00 – 12.00; admission is 6€.

From Kolkwitz we headed back towards Berlin; there were no other sites on our schedule for that day but once aboard the coach Mike informed us that we now had an additional bunker to visit at Gosen.

Gosen 28 May

The Gosen complex was built for the Hauptverwaltung Aufklärung (HVA) which was the foreign intelligence service of the GDR and was an integral part of the Ministry of State Security (Stasi), the equivalent of our Secret Intelligence Service (MI6). The HVA was under the control of Colonel-General Markus Wolf, who was succeeded in the late 1980s by Lieutenant-General Werner Grossmann. From the late 1950s, the HVA were based in the building complex of the Stasi's headquarters in the Berlin borough of Lichtenberg. After completion of new office buildings at the corner of Ruschestraße and Frankfurter Allee, the HVA established its base of operations there. In 1988, the HVA school, including the School of Foreign Languages, moved to Lake Seddin in Gosen 4.5 miles south of the city of Erkner on the outskirts of Berlin. A backup bunker for the headquarters of the HVA was also built there.

This huge shed conceals the two entrances to the Gosen bunker; the other entrance can be seen at the far end. This protected entrance is not provided at other standard Stasi bunkers.
Photo by Dan McKenzie

The cover name for the HVA school was 'Central School for Sport and Technology', but was known by its students as 'The Forest School'. In 1989, there were over 300 employees at the school which was run by Colonel Bernard Kaufmann. The college had three faculties: Faculty A - political theory training, Faculty B – 'special disciplines' and intelligence methodology and Faculty F – foreign language training for operational purposes, including interpreting.

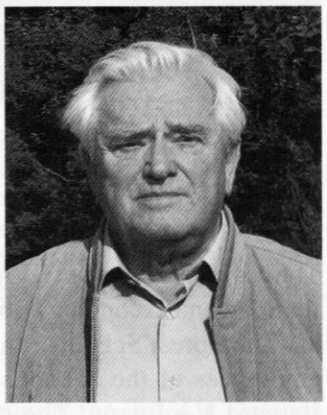
The bunker was designated 'Objekt K81/1' by the PBS, the EGER bunker planning group and was one of four bunkers on the site (one of the others was a bunkered garage): its codename was 'Kombinat'. The design was

based on the standard Stasi bunker type with two identical halves, using prefabricated concrete sections and then adding reinforced concrete to form a blast cap; the foundations are 20 cm thick and the roof slab is 25 cm. The bunker was designed to withstand a blast wave of up to 300 kpa/cm″ and high radiation and thermal levels and to provide protection against chemical and biological weapons.

The bunker was provided with 6 X 15kVA standby generators and two 2500 litre fuel tanks which were sufficient for 6 - 8 days autonomous operation. In the event of the bunker having to be completely sealed it could have operated for two spells of 12 hours. There were two identical ventilation systems, each with a capacity of 800 m≈/h, i.e. 11.8 m≈/h per person. Emergency ventilation would have been achieved manually using two fixed bicycle frames.

The water supply came from a deep well within the bunker with a capacity of 2.5 m≈/h. There was also a water filtration plant available with a capacity of 300 litres per hour. The bunker differed from the standard Stasi design in several ways with additional hardening including blast doors at the top of the entrance stairs and improved air intakes; perhaps this was a later modification as Gosen was one of the last standard design Stasi bunkers to be built. When fully manned the bunker would have had a staff of 135, of which 70 were operational personnel and 65 supply and support personnel.

Most of the sites on this year's tour were museum bunkers where knowledgeable guides are generally provided. Gosen is a derelict site so prior to the visit, Mike contacted Werner Grossmann to see if he would be prepared to guide us round 'his' bunker. Unfortunately he had other commitments on the day but offered to send his second-in-command Major-General Heinz Geyer and Colonels Nickel and Lohse; Nickel was the last bunker commandant at Gosen. Geyer had worked closely with spy chief Markus Wolf during the period when spies were infiltrated into NATO headquarters in Brussels and most notoriously of all, into the private office of the West German Chancellor, Willy Brandt. Sadly, Heinz Geyer died of a heart attack a few days after our visit at the age of 79 so this was, perhaps, his last engagement.



Major-General Heinz Geyer.
Photo by Tim Robinson

The bunker is entered from a large storage shed on a hill overlooking the school; the shed is completely empty apart from the two covered stairways, one at each end of the building. Once through the entrance blast doors it was clear that the bunker had been fairly thoroughly stripped but some equipment and plant still remains. The six generators have been removed but most of the ventilation and water plant, including the bicycle frames, are still in place as is part of the main distribution frame (MDF) in the telephone exchange.

Gosen also has its place in Cold War history: the 80s saw increasing tension on the missile front with the Soviet Union, on the one side, wanting to install the intermediate range ballistic missile SS-20 (NATO designator Saber) in the Soviet Union, with Germany well within its operational range, and President Carter's record defence budget (157 billion dollars) for the Trident, MX, cruise missile and nuclear submarine programmes on the other side.

The group with the HVA Generals at Gosen.
Photo by Tim Robinson

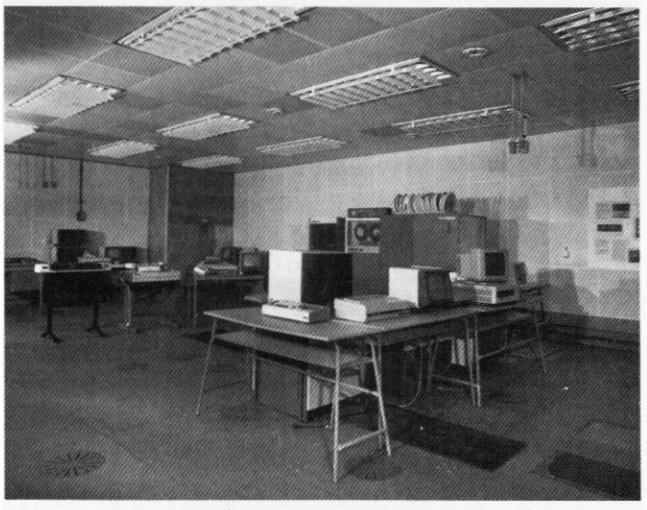
Carter was followed by Reagan (and the NATO double-decision in 83/84), and the Soviet Union saw the stakes being raised even higher with threat of a potential first-strike by NATO becoming even more threatening in their eyes. In an attempt to forestall this, the Soviet Union / Warsaw Pact set up the "Ryan" programme. "Ryan", the initials in Russian from the term "raketno-yadernoe napadenie" or "nuclear missile attack", was designed to track every single possible indicator of such an attack being prepared. This included not only reports from agents in the various ministries and government bodies in the West, but also from detailed observation of the Pershing 2 and cruise missile sites by agents on the ground.

To this end, the HVA set up a special reporting centre in EGER with direct links to Moscow, and a special working party of the Stasi head (Mielke) was organised to plan the urgent construction of bunkers for key elements of the HVA and Stasi. As a result, Gosen was planned to house the HVA leadership, although Markus Wolf, the then head of the HVA, was not particularly enamoured of the scheme since he doubted whether such bunkers really offered any real advantage. However, he did consider the large sheds and halls built to camouflage the bunker entrances "as being ideally suitable for social gatherings and for accommodating guests".

From Gosen we drove to Helenenau where we were to spend the next three nights. This is a former Stasi training facility, now a riding school.

Garzau 29 May

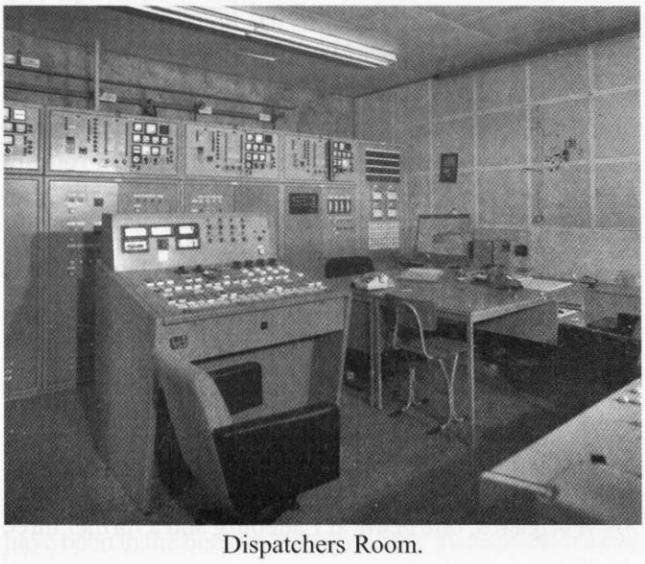
We had a short drive to Garzau, the former NVA computer and reporting centre. Each day all military units would upload their current status to the next higher level and so upwards until all the information arrived at Garzau where it was processed and a daily reporting chart was submitted to the NVA defence ministry in Strausberg and to the relevant ministers. The bunker has been retained as a museum.



The computer centre.

The Garzau computer centre is about 6 km southeast of Strausberg. Construction started in 1972 and the bunker was fully operational by 1976. The main entrance is from the basement of the administration block from where a 200-metre uphill tunnel leads to the lower floor of the two-level bunker covering approximately 4,000 sq. metres. The bunker was built by cut and cover with a reinforced concrete blast cap above the structure and is built into a nearby hill, with rooms being accessed from a ring corridor on both levels. There is an emergency exit from the upper floor with an adjoining shaft for heavy plant.

The bunker was designed to withstand a direct hit from a nuclear bomb and a displacement of 0.4 metres laterally and/or vertically was allowed for in the event of such an attack. Many of the internal floors are mounted on shock absorbing springs and the entire structure is contained with a 'Faraday Cage' to protect the electronic equipment from external interference following a nuclear attack. As in most bunkers, an overpressure was maintained inside the bunker to exclude dust, radioactive fallout particles and biological and chemical warfare agents. The bunker has its own water supply, with water being drawn from an 80-metre well. The bunker was designed to operate in self-contained mode for 24 hours before a decision had to be taken whether or not to continue in totally sealed mode for up to 14 days.



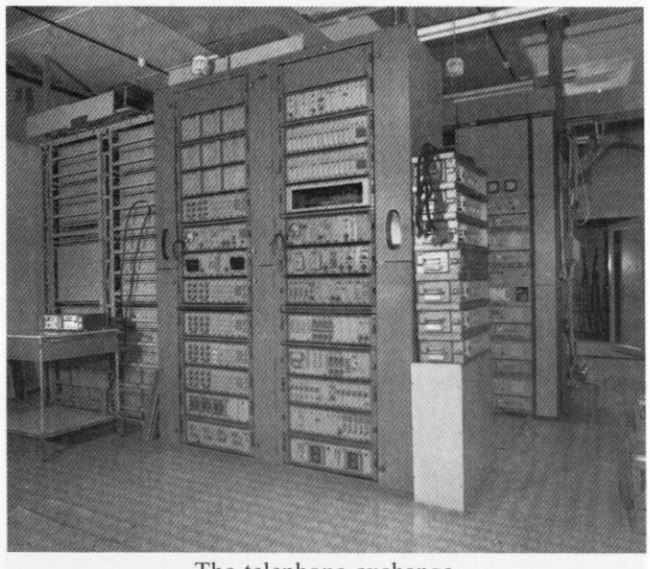
Dispatchers Room.

The original East German computers were removed but some have now been reinstated. The bunker contains all the usual plant and equipment, four marine diesel generators, air conditioning and filtration plant, water pumps and purification plant etc; this is all in working order. There is also a fully equipped kitchen and an extensive telephone exchange.

The museum is open on the last Sunday of each month throughout the year with guided tours lasting 90 minutes at 4pm. The bunker can be opened on other days by special arrangement. Admission is 10€.

Wollenberg 29 May

From Garzau it was a short drive to Wollenberg, a former NVA tropospheric site and one of the three stations in East Germany of the Warsaw Pact BARS tropospheric link back to Moscow. This facility was covered in detail in *Subterranea* 11.



The telephone exchange.

Harnekop 30 May

Our first excursion of the day was to see the NVA's underground communication and command centre at Harnekop (designation Objekt 16/102), a three-level bunker serving the East German defence ministry at Strausberg. In the event of war, Harnekop would have

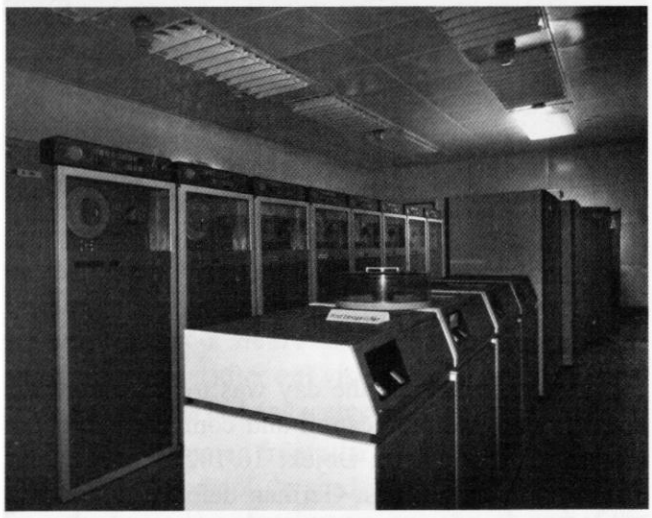
The operations room.

served as the main command post for the NVA within the Warsaw Pact Supreme Command

Harnekop is about 14 km north-northeast of Strausberg and was a very closely guarded secret. The bunker is hidden deep in the forest to the west of the village.

It was built under great secrecy between 1971 and 1976. In order to draw attention away from the genuine excavation a 'decoy' excavation was made elsewhere and the real hole excavated at night under cover of camouflaged tarpaulins. Workmen were only employed for short periods and then replaced, so none knew the full extent or nature of the construction; excavated spoil was sprayed with liquid manure to disguise it. Visiting officers from Strausberg were driven at night in buses with blinds down and via a long and tortuous route. The 16km round trip from Strausberg could take up to two hours; NVA staff even wore East German Post Office uniforms to maintain the cover. As usual there was a 'cover story' at Harnekop, local people being told that the facility was a weather monitoring station for aviation.

As with the computer centre at Garzau, Harnekop has a high level of protection against a nuclear attack. Many of the rooms have sprung floors and the bunker was able to withstand 0.4m lateral and/or vertical displacement. External walls are 3m thick and internal walls 1m thick. The main entrance into the bunker is from the basement of the HQ block, from where a tunnel leads into the upper ring corridor.



A main-frame computer was exported to Russia, then immediately brought back to Harnekop in secrecy.

In wartime, the bunker would have had a staff of 450, comprising 200 officers and 250 technical and domestic staff and could have operated in sealed mode for 25 days. There are four dining rooms and beds for 160 people so a 'hot bed' system would have been in operation.

Outgoing signals from the bunker would have been carried by buried cables to remote transmitters at Kunersdorf and Wollenberg, so as not to give away the bunker's position to persons monitoring the radio frequencies, but it could, if required, transmit directly up to 200 km from antennae buried 0.8m below the ground around the structure. It was also possible to broadcast via DDR radio or television networks.

A main-frame computer, made in Jena, was exported to Russia, then immediately brought back to Harnekop in secrecy. Much of the original equipment remains in place but the computer is not original although it is the same type.

In the event of a power failure, the bunker was equipped with four marine diesel generators which could be in operation within 20 seconds and if they failed there was sufficient battery power to keep the bunker functioning for 24 hours.

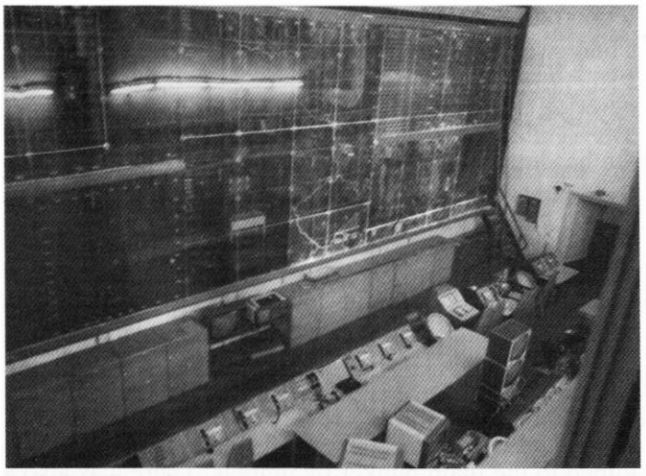
Throughout the 1980s, the bunker remained undetected by NATO Intelligence and was only revealed in 1990, on the day of German reunification. In May 2000 an association was established to restore and administer the bunker with the eventual aim of opening it to the public. The bunker was declared a national monument in 2001.

Public tours take place on weekdays March – October at midday and at weekends every two hours from 10.00am. From November – February there are weekend tours at 12.00 and 14.00. Admission is 10€.

When we first visited the bunker in 2001 photography was strictly prohibited but this has now been relaxed, at least for foreign visitors. Harnekop is a big well-equipped bunker with plenty to see and I felt we were rather hurried round and probably didn't see everything. There was always a member of staff at the back of the party to ensure that nobody wandered off but we were still given an excellent tour.

Ladeburg 30 May

Ladeburg was the headquarters of the NVA's 'Hermann Duncker' 41st Surface-to-Air Missile (SAM) Brigade. It was part of the 1st Air-Defence Division with its headquarters at Cottbus and its command post at Kolkwitz, within the East German Air Force/Air Defence Service. The NVA SAM units were formed into three SAM brigades, one being at Ladeburg and a further three



The two-level situation room before the equipment was removed.

SAM regiments with a total of 3000 surface-to-air missiles.

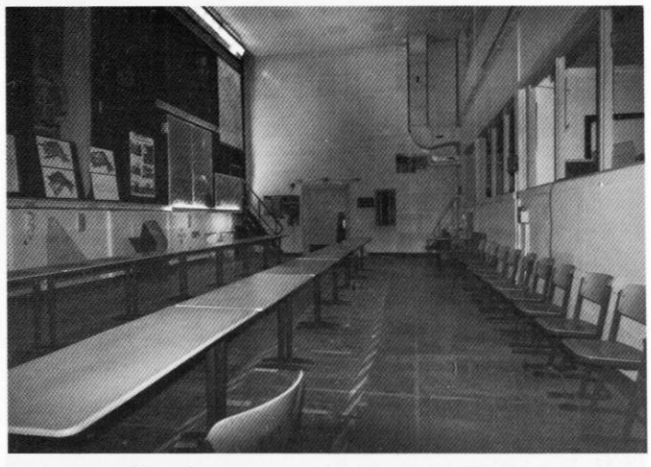
The 41st SAM Brigade itself consisted of three air-defence complexes, each comprising four SAM battalions, armed with Volchov SA-2D missiles (NATO 'Guideline'), for short and medium ranges, six ramps each with one missile and Neva SA-3C missiles (NATO 'Goa'), for low to very low flying aircraft, four ramps each with four missiles) and a technical battalion, plus a special SAM Group (FRAG-411) at Badingen/Osterne, armed with the long-range Vega SA-5 missile (NATO 'Gammon'), for important targets such as AWACS, incoming missiles, etc., high range, high speed, six ramps each with two re-loaders.

The Ladeburg facility included a Technical Battalion (TA-4120) and a radar battalion (FuTA-4101). The latter, via several links upwards, would eventually have been reporting to the NVA HQ for air defence at 'Fuchsbau', Fürstenwalde. Both the Soviet equivalent, 'UK-20', and 'Fuchsbau' would have passed on the air defence air picture to the Warsaw Pact air defence HQ in Minsk. The command post at Ladeburg was built between 1983 - 1985 amongst its other roles the radars provided ground control intercept cover for the fighter squadrons at Holzdorf and Marxwalde. The complex comprises the two-level command bunker and an adjacent range of garages, three radar 'hills' and a staff bunker for the radar personnel. We walked up to one of the radar platforms which are all located at the top of artificial hills within the radar technical compound; there is little to see apart from the mountings for the radars and ventilation shafts for the garages below the hill.

The command post has a floor space of approximately 1,500 m″ with 68 rooms. The heart of the bunker is a two level situation room with a map wall overlooked by offices on two-levels. The room is very similar in size and design to our own regional war rooms. The bunker is protected by a 3.75-metre reinforced concrete blast cap. It was permanently manned as part of the Warsaw Pact alert system and at any one time a minimum of 30 people would have been in the bunker; but when fully manned the bunker had a complement of 110 with a further 60 in the adjacent garages.

The upper level comprises; air conditioning plant, filtration and ventilation plant, compressed air system, medical centre, kitchen, dining room, restrooms, washrooms and toilets. A number of offices overlook the situation room below. The lower level comprises: dispatcher's room, standby generators, fuel tanks, waterworks, communications and encryption centre, radio room, communications room, office and the situation room itself. The command centre itself has been well restored with most of the kit back in place. Here we were given a free hand: either stay with the tour or wander round on your own. The bunker and the adjoining garages are separated by a 2m layer of gravel, but were linked by a system of airlocks. The two garage complexes were some 48m long, 15m wide and 7 m high and were protected by heavy blast doors. These have now been sold for scrap and have been replaced by wooden doors; each garage complex had its own ventilation system. The garages are now in private hands and not part of the museum.

In 1990, the Bundeswehr took over the site and intended to carry out explosives trials in the bunker but this was not well received by local residents. The Bundeswehr left the bunker in December 1991 and the bunker was first opened to the public in 2002.



The situation room as it appears now.

The site also has two further bunkers: a Type FB-3 and an FB-75. The FB-75 is identical in design to the staff bunkers we had seen at Kossa and is also used at other NVA sites. It is located within the radar technical area and provided protection for radar personnel. It is a two-level bunker; the upper entrance level contained the airlock, toilets and washrooms and the filter system with stairs down to the lower level from where the corridor radiates in three directions. The lower level has a switch room, air-conditioning and water supply/sewage and three large rooms that were used as classrooms and offices. The bunker is largely stripped apart from plant. From the lower corridor, there is further access to the upper level where there was sleeping accommodation and an emergency exit shaft.

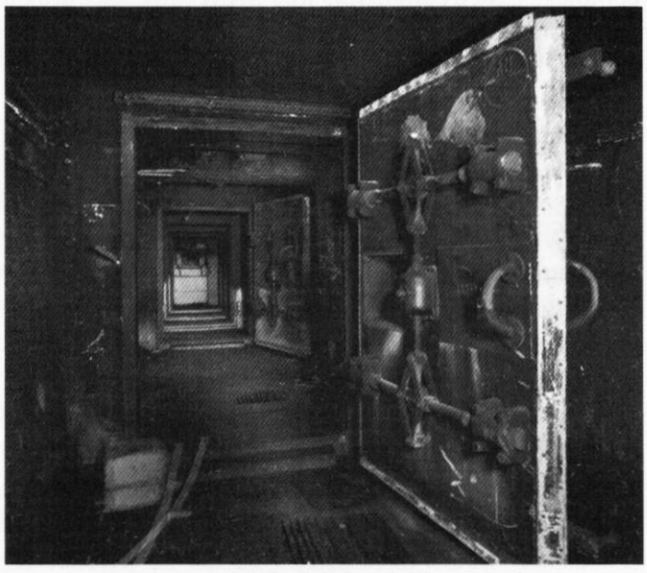
The bunker is open at weekends and holidays by appointment only; tours last 90 minutes for which there is a charge of 5€. Compared to the other bunker museums we visited during the week which are well established and professionally run, Ladeburg is run by a small group of very enthusiastic young people almost as a hobby. The bunker is owned by an animal sanctuary and all the proceeds go to them rather than the group who run the bunker. Our tour was considerably longer than the usual 90-minute public tour. We were all impressed by the enthusiasm of this young group and we decided to make a donation to them as well as to the animal sanctuary as we felt the money would be put to very good use in the bunker.

Möhlau 31 May

In wartime, the Western Group of Forces (WGF), previously known as the Group of Soviet Forces in Germany (GSFG), would have become a 'front'. This is a Soviet/Russian strategic military term and is not the same as being in the front line; more a collection of armies and supporting forces. WGF would have become the 1st West Front. Its main command post (CP) would have been in Möhlau south east of Dessau, its forward CP in Lossa, its alternative CP in Bardenitz (NW of Jüterbog) and its rear CP in Merzdorf (E of Jüterbog), sites that numerous Sub Brit members have previously visited. There was also an air defence command element at Felgentreu (near Jüterbog).

Protection against asbestos and other toxins was a requirement at Möhlau. Photo by Mark Bennett

Access to the bunker was originally via the basement of the headquarters building, as is normally the case. The main bunker is cast concrete and was built in the 1970s adjacent to the headquarters building. It was constructed specifically for its role and resulted in changes to the functions of existing high-level bunkers and facilities, which had not lived up to expectations. The original two-level bunker was extended at a later date with the addition of two 'wings', each comprising two tubes and a head unit constructed of pre-cast arched concrete sections and joined to the main bunker by tunnels. There was also a garage complex which could house a mobile Almaz front command air-defence display system. There is also a further, smaller bunker complex to the south of the main site which would have been used for air defence purposes.



Smoke-damaged airlock between the main bunker and one of the wing bunkers.

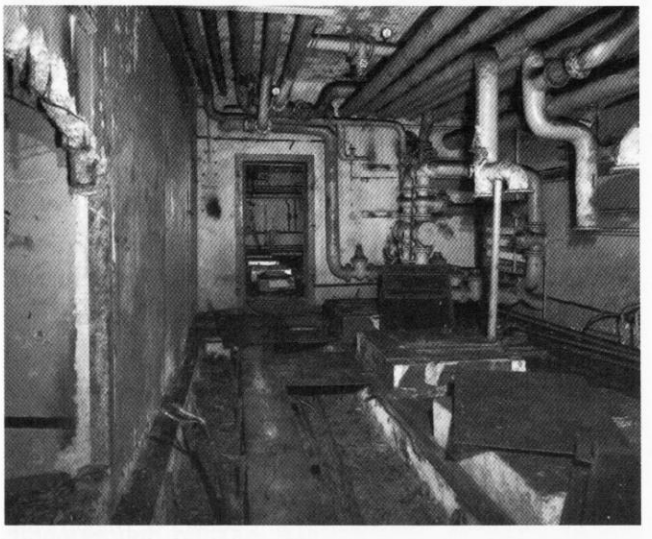
Although stripped by the Russians when they departed, the bunker initially remained in good internal condition until it was further stripped of all its internal wiring by illegal scrap dealers. This involved pulling up the floor and burning the insulation off the wiring inside the bunker leaving it in an appalling and dangerous condition. Following this theft, all the surface buildings and associated structures have been demolished leaving no trace whatsoever; these included satellite facilities and underground aerial masts which could be raised when required. The bunker was sealed but in recent years access has been restored through one of the emergency exits. The barracks which were located some distance away from the main site have been retained as temporary accommodation for asylum seekers.

For some members of the group, Möhlau was the highlight of the week, but for others it was an anticlimax. It had always been intended that we would end the tour with the massive Nazi underground weapons factory at

Halberstadt which was later used by the NVA and then the Bundeswehr as a stores and mobilisation depot. We were able to visit Halberstadt in 2003 but due to the recent illegal dumping of rubbish there criminal proceedings have recently been initiated against the owner so Möhlau was included as an alternative.

There is a private road through the forest to the bunker site so we were able to get the coach very close to the bunker which to the untrained eye is now invisible in the forest. We walked a short distance and then climbed up onto a ridge which was, in fact, the top of one of the wing bunkers. At the far end of the ridge one of the emergency exits had been reopened and we were able to drop down into the bunker with the help of an old ladder which was found inside.

We had been pre-warned to bring face masks due to the internal condition of the bunker, for not only is there asbestos everywhere but also dioxins and furans given off when the insulation was burnt off the wiring. Once everybody was adequately dressed for the occasion we proceeded through the bunker. Being such a large and complex bunker most people walked round at their own pace on the strict instructions that we had to be out by 4pm.



One of the many stripped plant rooms at Möhlau.

The west wing bunker is on two levels with stairways at each end. Most of the rooms appeared to have contained equipment or plant most of which has now been removed. At the east end of the bunker there is a system of airlocks and decontamination rooms from where a tunnel runs east to the upper floor of the main bunker where there is a blast door and further decontamination rooms.

Progress is at times difficult along the corridors on both floors following the removal of the floorboards and the stripping of the wiring beneath. Most of the rooms are empty apart from engine beds and the metal framework for supporting machinery and plant. On the lower floor, the largest room in the bunker was clearly used for burning the insulation of cables and is completely burnt out.

On the upper floor of the east side of the bunker there is a further exit through decontamination rooms and another blast door; this leads to a long tunnel that eventually ends in a blockage. Part way along this tunnel a further tunnel branches to the south passing through further decontamination rooms into the south wing bunker which is identical in size and construction to the west wing. This bunker is generally clean and free from contamination. A few rooms have had equipment or plant but most of the rooms appear to have been used as offices. At the south end a further blast door leads to a blocked exit. There are some signs, all in Russian, in various rooms throughout the bunker.

Everybody was out of the bunker on time; the last to emerge was our coach driver, Andy Becker, who had been in the bunker with an attractive young lady reporter keen to write a story on bunkers. Andy knows nothing about this bunker in particular or bunkers in general so I can only guess at what they were getting up to underground for four hours. Gives a whole new meaning to subterranean exploration!

We overnighted in Halberstadt before the long drive back to Calais the following day. It was a tiring but thoroughly enjoyable week; the pace was slightly slower than the inaugural tour in 2001 with a maximum of two bunkers per day, most of which were museum sites and easy going but I know everyone had a good time and we are all looking forward to the next tour. Mike and Robin are both very adamant that there won't be another tour on this scale but that's what Mike said on the first tour in 2001 and I've been back to East Germany with Mike every year since on much smaller tours - so never say never!

Sources:

Notes supplied by Mike Barton

Notes from Paul Sowan on Machern, Garzau and Harnekop visited in 2001

Bunker museum web sites:

Machern & Runde Ecke http://www.runde-ecke-leipzig.de/cms/ (includes poor English version)

Kossa http://www.bunker-kossa.de/

Kolkwitz http://www.kbf-gs31.de/intro.html

Garzau http://www.outdoor-sports-paintball.de/bunker/home/index.htm

Wollenberg http://www.bunker-wollenberg.de/

Harnekop http://www.atombunker-16-102.de/ (includes one page in English)

Ladeburg http://www.beepworld.de/members77/bitti62/ (includes one page in English)

All photos by Nick Catford unless stated.

Colonel Stephens' Light Railways and Tunnels

Paul W. Sowan

Colonel Holman Fred Stephens [1868 – 1931] operated a series of light railways (many of them authorised under the Light Railways Act, 1896) throughout the southern half of England and parts of Wales and the Welsh Borders, all controlled from his office at Tonbridge in Kent. Numerous others such were projected but never built.

Notoriously cheaply constructed and operated, the majority of these lines were laid on flat ground, calling for minimal earthworks. He has only two railway tunnels to his name, one of them half-completed, the other never commenced.

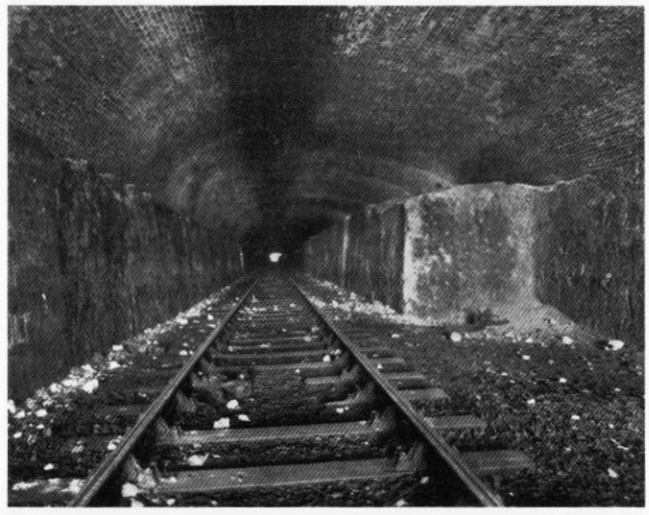
Golgotha Tunnel west portal in April 2008.

The Golgotha tunnel on the East Kent Light Railway

The East Kent Light Railway, opened in 1911, was projected primarily to serve the freight needs of the Kent coalfield, although subsequently passengers were also conveyed between Shepherdswell, on the London, Chatham & Dover Railway's Canterbury to Dover main line, to a junction at Eastry, from whence ran lines to Richborough Port and Canterbury Road (some 6 miles short of Canterbury.) A number of collieries (such as Wingham at TR 2557 and Woodnesborough at TR 2956), partially developed in the district, failed before production commenced, although that at Tilmanstone (TR 2850) sent coal to the docks at Dover via the EKLR and the main line, at least until the mine short-circuited this route when it constructed an independent overhead conveyor system direct from the pit head to the Eastern Docks (via its own twin tunnels through the chalk cliffs, the bricked-up entrances to which can be seen from the ferry terminal).

The line from Shepherdswell (TR 2548) to Eythorne (TR 2849) was to have run across flat land around a small hill, but disagreements with a landowner led to Stephens driving his only tunnel, the 550 yards Golgotha tunnel (TR 265488 - TR 269490) between those two stations.

This, approached from Shepherdswell via quite a deep cutting, was planned to be a single bore twin-track tunnel, and was equipped with appropriately wide portals. However, to save on costs (the hallmark of Stephens' lines) only half the chalk was excavated and a single track laid through the opened-out western side of the structure. The line through this tunnel opened for business in 1912, but was closed (by then operating freight only) in 1987. It has subsequently been reopened and is now used for trains operated by a railway preservation society - the East Kent Railway - based at Shepherdswell, running standard gauge trains through the tunnel to Eythorne and back.



To save costs only half the chalk was excavated. The remaining chalk could be removed if the line through the tunnel was ever doubled. This view is just inside the west portal in June 1994.

The intended Tatsfield tunnel on the proposed but never built Southern Heights Light Railway

Among the numerous intended lines that were never built, Stephens in the 1920s backed the so-called Southern Heights Light Railway which was to have taken a circuitous and in places steeply graded route over the North Downs, from the existing Sanderstead station on the Croydon to Oxted line, to the existing Orpington station on the line from London to Tonbridge. It was intended to work this by third-rail electric trains to be operated by the Southern Railway, these being capable of the envisaged gradients. There would have been intermediate stations (from west to east) at Mitchley Wood, Hamsey Green (near Warlingham), Chelsham (for Warlingham), and thence via a tunnel to Tatsfield, Westerham Hill, Cudham & Biggin Hill, Downe & Keston, and Green Street Green (for Farnborough.) The thinking behind this plan was to encourage the spread of suburbia southwards from Croydon and Bromley, much as the Metropolitan Railway had done to the north and west of London. Plans made in or around 1928 were subject to much debate, but on Stephens' death in 1931 no further progress was made.

Other inter-war proposals to expand the railway net and suburbanisation south of London were more successful. The line from Wimbledon via West Sutton to Sutton, opened throughout in 1929 – 1930, includes a steeply graded deep chalk cutting on the approach to Sutton. The intended line from Motspur Park to Leatherhead was completed and opened for traffic only as far as Chessington South in the years 1938 – 39, but never completed southwards after World War II. Thus there still stands a length of abandoned embankment beyond the terminus.

Underground Darwin and the Second World War

Martin Dixon

The Bombing of Darwin

Almost everyone has heard of the Japanese attack on Pearl Harbour that took place on December 7 1941. What far fewer people realise (even in Australia) is that the Japanese fleet responsible for the attack later headed southwest and on February 19 1942 launched a devastating attack on Darwin. Darwin, on the north coast of Australia and capital of the Northern Territory, was an important staging post in supplying Allied troops in the southwest Pacific. During the attack ten ships were sunk in the harbour and many others damaged. What little air cover there had been mostly destroyed on the ground and over 240 people were killed. It is said that more tons of bombs were dropped in this initial raid than were dropped at Pearl Harbour.

This first raid happened just a few days after the Allied surrender in Singapore and the relentless progress of the Japanese across the Pacific posed a huge threat to the Australian mainland. Darwin suffered a further 62 air raids in the following 20 months. Much of the Allied shipping was dispersed around other Australian ports but a large number of airfields were built in the area, and troops numbered in the hundreds of thousands. Australian troops returning from the European theatre were supported in particular by US Forces. The defences at Darwin were significantly increased including the building of a number of underground installations, some of which we visited on a recent trip to Australia. The four Japanese aircraft carriers that took part in the initial air attack on Darwin were later sunk in the Battle of Midway in June 1942.

RAAF Explosives Storage

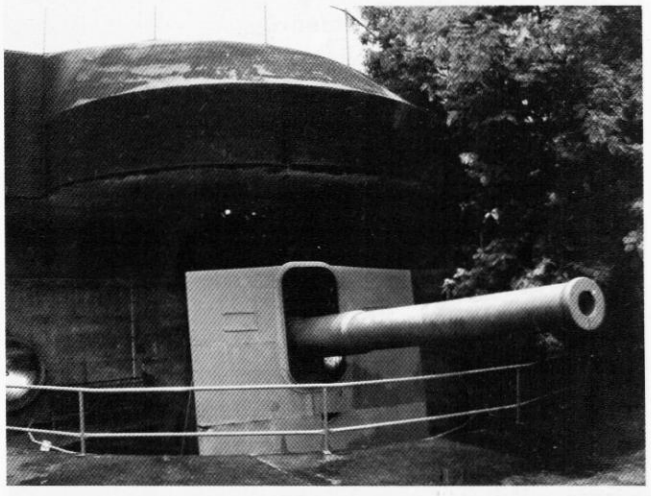
We first drove to the outskirts of Darwin to what is now the Charles Darwin National Park. This has been established on what was one of a number of dispersed explosive, ammunition and bomb storage facilities for the Royal Australian Air Force. The site was constructed in 1944 and in use until the mid 1980s. It consists of 12 concrete semi-underground bunkers, built into the natural contours, protected by natural rock and covered over with earth and vegetation. Each bunker was protected by hose reel and standalone fire extinguishers, evidence of which remains. One of the bunkers has been laid out with Second World War displays and material and the structures all appear to be in good shape.

Store 8 at the RAAF Explosives Store

It is pleasing to see the military structures remain well maintained alongside natural features as part of the Australian National Park system. Indeed, they are listed as Heritage structures as are a few other associated buildings (probably providing accommodation, test and assembly facilities). The site was once serviced by a narrow-gauge railway. One of the shelters has evidence of 12.7mm projectiles, attributed to Japanese strafing. We didn't have time to locate this, partially due to attacks by the local 'sand flies' (similar to Scottish midges and just as persistent).

East Point Command Post and Gun Emplacements

Several gun emplacements were constructed to protect Darwin harbour and one of these – at East Point – is particularly accessible. It is located within what is now East Point Reserve – a 200-hectare area managed by Darwin City Council. The military remains are on Australia's Register of National Estate and represent the last fortress built in Australia in what is its only battleground. It is again commendable the extent to which recreational activities co-exist with the built environment so harmoniously. The site was home to both 6 inch and 9.2 inch emplacements and associated control and storage buildings. The main command post bunker operates as a museum and includes a wide range of artefacts and memorabilia. There is also a well put together film of the events of the Second World War as they affected Darwin.



Replica 9.2 inch gun at East Point Battery

The displays include the ranging tables for both the 6 and 9.2 inch batteries which are in good condition. An additional entry has been cut into the bunker for tourist access. As well as underground storage associated with each gun, there are

Underground Magazine at East Point Battery

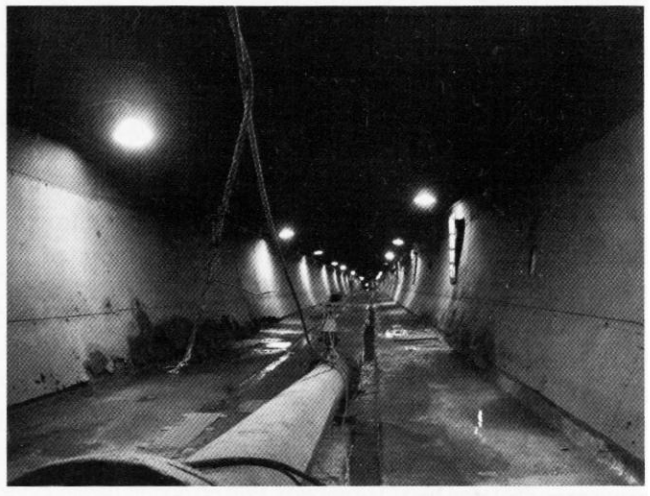
also underground ammunition stores with only their ventilators visible. One of the 9.2 inch sites, which is reminiscent of contemporary Atlantic Wall structures, has had a fibreglass replica of the gun installed which is a nice touch. The original gun cost 284,000 Australian pounds and the scrap value was just 550 Australian pounds. In the ultimate of ironies the guns were scrapped in 1959 to the Japanese Fujita salvage company….

Underground Oil Storage tunnels

In an air raid in 16 June 1942, oil storage tanks around the harbour at Darwin were set on fire. Of the original eleven tanks, dating from 1924, seven were totally destroyed. By November 1942 a decision was made to construct eight underground oil storage tunnels, of which five were eventually completed. Access tunnels with a horseshoe-shaped cross-section were built from the dock level back into the higher ground on which the main city of Darwin stands. Dug using hand-held pneumatic picks, these access tunnels are around 2 metres high and lined in concrete and steel. Oil pipes, vents and air-handling ducts still run along the tunnels. The oil storage tunnels themselves lead off from deeper inside the complex. They have a cross-section of 4.5 metres in width and 5.4 metres in height and vary in length between 77 and 184 metres. In total they had a capacity of around 15 million litres of fuel oil. Each of the tunnels was lined with concrete and an inner tank of welded steel fitted within.

The tunnels were completed too late to be used for their intended purpose but two of the tunnels (numbers 5 and 6) were used in the 1950s for the storage of jet fuel (kerosene). In 1992 – 50 years after the initial bombing raids - the tunnels were opened as a tourist attraction. It is possible to enter

Main entrance to Oil Storage Tunnel complex
(large pipe on left is recent air-handling)



Oil Storage Tunnel number 5 (171 metres long)

storage tank 5 along an access tunnel which is around 50 metres long. An entrance has been cut into the storage tunnel itself and the full length can be explored. The steel lining exists except at floor level where it has been removed for safety. The concrete floor clearly shows a water drainage channel (the tunnels continue to suffer water ingress, particularly after heavy rain of which Darwin has lots). Photos of the construction and of Darwin in the Second World War line the tank. The oil filling and extract pipes can still be clearly seen though the pumps which lived in a lobby area outside each tank have been scrapped. It is also possible to view storage tank number 6 though entry to this is not possible.

Darwin suffered the catastrophic Typhoon Tracy on Christmas Day in 1974. [As an aside a world record was set when Qantas loaded 673 passengers on a Boeing 747 during the subsequent evacuation.] Many of the surface buildings were destroyed and so today Darwin has a modern and fresh feel. Its underground structures fared better and Darwin is to be congratulated for preserving and presenting this heritage.

All photos by Martin Dixon

Ghost Metros of Belgium

Keith Ward

There is a fascination with closed stations and lines on the world famous London Underground, Paris Metro and New York Subway systems which have many closed stations and lines. However a lot of the smaller metro systems have their own interesting odds and ends. One of the most fascinating countries for this is Belgium, where similar indecisive planning to the UK has resulted in a number of 'white elephant' schemes, most notably the Charleroi light metro.

Charleroi Light Metro

This scheme, in the planning since the 1960s, was to replace the local tram network (part of the vast Vicinal system whose inter-urban lines had criss-crossed Belgium until succumbing to buses) with a subway and elevated metro system. The Charleroi area and interurban route 90 to Anderlues and La Louvière were incorporated in the light metro scheme.

The scheme came to fruition in 1984 with construction of a vast four-platform semi-underground station at Beaux Arts in the centre of Charleroi. Many street tracks were transferred to new concrete viaduct alignments with vast stations and infrastructure. Charleroi was a major steel production area heavily hit by the recession and this scheme was seen as a stimulus for growth which unfortunately didn't happen. The trams remained empty; the small two-car BN light rail cars delivered for the scheme looked out of place in the vast empty stations. The main components of the scheme were two underground and elevated new Metro lines to Chatelet and Gilly. These lines were built with the usual vast infrastructure and in most cases the track was laid but never opened. Now the stations are the playground of graffiti artists who walk through the weed-strewn track. In some places the catenary masts were put up but the track never laid.

Station Sart Culpart Station on the Gilly line of the Métro Léger Charleroi (Charleroi Subway) was never completed, although there are still plans to open the station.

In May 1990 I visited Charleroi and without the help of the web was unaware of the unopened sections. However I visited Beaux Arts station to ride the interurban metro to La Louvière. On a Saturday afternoon the vast station was deserted until the hourly tram arrived - a modern BN car. I joined about six passengers as we whisked through the vast stations and along the impressive concrete viaduct. Not a single passenger was picked up until we reached Anderlues depot where myself and the other six alighted allowing one old lady to board for Louvière! Not surprisingly the service to La Louvière was cut back in the early 1990s to Anderlues which enjoys a 30 min service.

Beaux Arts Station is an underground four-platform station in the centre of Charleroi. There is an underground loop line to take trains from one side of the station to another. This is the most lavishly built station on the light metro.

The line from Anderlues to the start of the metro alignment is classic Vicinal single track roadside with automatic signals that only light up when the trams are in section. At one point the single track suddenly swings onto the massive concrete viaduct and onto quality infrastructure and double track. As part of the scheme many tram routes were temporarily replaced by buses but the trams never returned. Politicians talk about completing the Metro from time to time but nothing happens apart from the closed stations getting further graffiti. Many websites feature this Metro graffiti.

On my visit I found Charleroi to be a very down-at-heel town and there cannot be any justification to open the Metro further unless justifying the millions already spent on the first stage of scheme.

Liège Metro

This is more bizarre than Charleroi in that there are so many stories circulating that it's become an urban legend.

In the early 60s plans were made to put trams in a subway in the centre of the city. Some cars had destination blinds

created for the subway (whence the legend!) but a change in policy saw the trams ousted by buses in 1967. In the late 1970s plans for a 22-station VAL (French style automated metro as in Lille/Lyon) came to nothing although some short tunnels were partly built. Belgium's preoccupation with roads saw a number of road tunnels built and one of the VAL tunnels was converted to an underground garage. The scheme kept rearing its head but nothing happened. Finally, in 2006, part of the VAL tunnel (according to the press release) was converted into a bus tunnel to serve a new central bus station. There is also a busway from the main rail station to the town centre which allegedly uses the alignment reserved for the VAL, although this is on the surface. There are supposedly two complete stations built (this is shallow sub-surface construction) with subway entrances. Perhaps we should have a Sub Brit recce to find out the truth!

Antwerpen pre-Metro

In Brussels and Antwerp as in many German cities, the trams were put in subways in the town centre with conversion planned at a later date to full Metro operation. Some stations had short low platforms for trams with high platforms next to them for the future Metro fenced off. In Brussels a full metro system was developed using some of the 'pre-Metro' tunnels however some tram-only subways remain in use solely by trams.

Antwerp operates an extensive tramway network and from 1975 the central area track was put underground with a number of underground stations. However a number of stations (7 in all) were built underneath the tram stations. During construction a two-level box was built with trams on top and future Metro station below; these Metro stations were just empty shells. A new project Pegasus is being planned which will see the low-level stations opened as tram stations to serve three new fast tram routes to the suburbs. In view of the complicated politics of Belgium whether it happens is anybody's guess!

Heyzel Tram Subway, Brussels

The City trams terminate at an impressive four-platform station at the Heyzel stadium and exhibition centre. However the former Vicinal tramways had a lengthy tram subway with two shallow underground stations running through the grounds. This line closed in 1967, with the non-subway section taken over by city trams, but in 1994 the subway was reopened as an extension to the extensive city tram network. I was able to walk the subway in 1991 when it was derelict.

Ghent Tram Subway

There were proposals from the 1950s onwards to use old canal beds as the basis for tram subways in city centre. As far as is known, nothing was ever built.

Malmo's "Crossrail"

Robin Cherry

There is a new tunnel (more precisely two parallel tunnels, like the Channel tunnel) being built under the city of Malmö in southern Sweden. In 2011, the first scheduled train will leave the new underground station at Malmö Central. It will travel 25 metres below ground, through the new tunnel, via Triangeln Station all the way to Hyllie Station. After 6 km in a tunnel, it will reach the surface in southern Malmö. The railway will divide here and go west towards the Öresund Bridge, south towards Trelleborg and east towards Ystad.

At present, Malmö Central Station is a dead-end and trains going onward from here have to change direction which causes delay. The plan is for 17 km of railway above and below ground, the two parallel tunnels having an inner diameter of 7.9 metres. The distance between the tunnels will vary between 10 and 30 m and they will be linked by 13 cross/evacuation tunnels at 300 to 400 metre intervals. In addition, there will be two access shafts to the surface. Including Triangeln Station, that means there will be access to the surface for every quarter of the tunnel.

At Slottsparken (Castle park) at Kung Oscars väg today, next to nothing is visible. All that remains of the construction site is a small hut that that has been there for some time and will be replaced by a more permanent access point. Restoring groundwork has been in progress for a while and is almost finished, but there is still activity underground. Stairs will provide access from ground level to the tunnels and will join a cross passage between the two tunnels. This is one of the rescue service access points in case of a future accident in the tunnel.

Source: Observation and website: www.malmotunnel.com

Building a station under a road junction in Malmö called 'Triangeln' (The Triangle). Photo by Klas Andersson

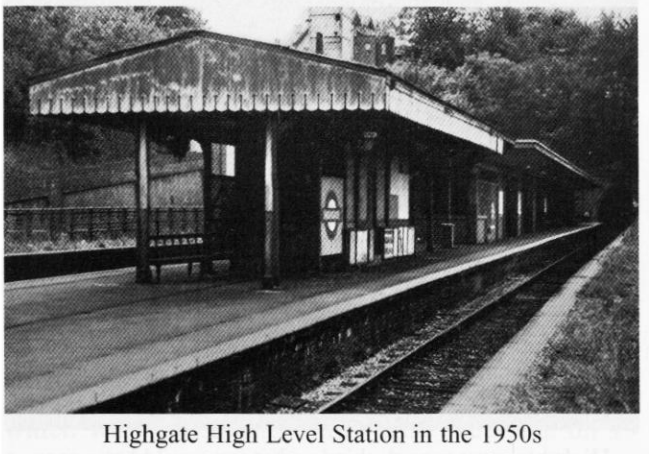
Another weekend on the London Underground

Nick Catford

When Sub Brit member Philip Lindhurst first mentioned that he was planning to organise a visit to some disused tube stations I don't think he had any idea just how popular this was likely to be. The first excursion on 19 January 2008 attracted 22 members who answered what was almost a throwaway post to the e-mail list the previous October stating that he "might be able to arrange something"; so vague in fact that many members dismissed it. It was soon clear however that Philip could deliver the goods, so when a second excursion was arranged for weekend 1 - 2 March he was inundated with requests for a place. I managed to go along on both days.

Highgate Station

Our first site was Highgate Station, probably the best preserved closed station anywhere in the London area.



Highgate High Level Station in the 1950s
- note the London Transport roundel.

The Edgware, Highgate & London Railway (EH&LR) obtained an Act in 1862 to build a line from a junction with the Great Northern Railway (GNR) at Seven Sisters Road (now Finsbury Park) to Edgware. The following year, the Midland Railway received authority to build a line between Bedford and St. Pancras which would provide a quicker route into central London from the Mill Hill area. To improve the prospects of their Edgware line, the EH & LR proposed a branch from Highgate to Muswell Hill (serving the new Alexandra Palace leisure complex) with an extension of the main line from Edgware to Watford.

Both proposals were approved by Parliament in 1864, as was a further branch from Finchley to High Barnet in 1866. In 1866 a further act was obtained by the independent Muswell Hill & Palace Railway to extend the branch from Muswell Hill to a terminus adjoining Alexandra Palace.

The 'main line' between Seven Sisters Road and Edgware proved more costly than expected and shortly before completion the local company was taken over by the Great Northern who opened the line on 22nd August 1867. There were intermediate stations at Crouch End, Highgate, East

Highgate High Level Station in May 1968.
Photo by Nick Catford

End Finchley, Finchley, Hendon and Mill Hill; the extension to Watford was never built. On 1 April 1872 the High Barnet branch was opened with the Alexandra Palace branch opening on 24 May 1873.

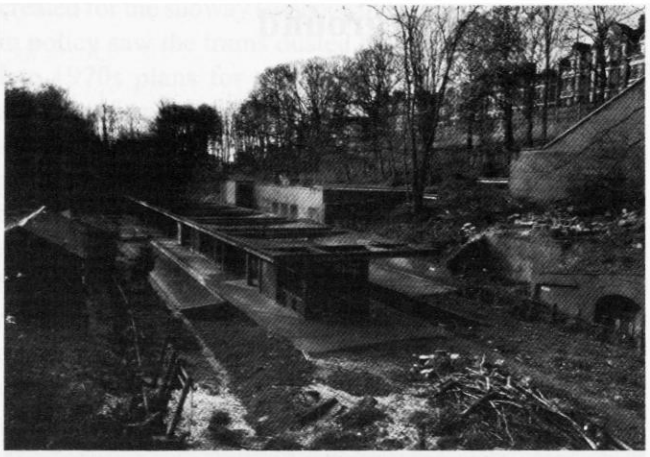
In 1935 the London Passenger Transport Board announced their 'New Works Plan' which included a proposal to take over the ex-GNR line between Finsbury Park and Edgware and High Barnet, including the Alexandra Palace branch. These would be incorporated into the Northern Line with a new connection with the Northern City line at Finsbury Park providing a fast and frequent service of electric trains into central London.

The 'New Works Plan' was adopted and shortly before the start of WW2 the lines began to appear on underground maps. It was expected that Northern Line trains would be running into Alexandra Palace by 1940. Work on the electrification and new infrastructure started alongside the steam service which continued to operate.

With the start of WW2, work on the electrification of the Alexandra Palace branch ceased in 1940 although some work continued north of Highgate on the Edgware and High Barnet lines. London Transport had every intention of completing their 'New Works Plan' and although several lines (including the Alexandra Palace branch) were shown 'under construction' on some underground maps until 1950, work never restarted.

With the opening of the Northern Line Extension from Archway to East Finchley on 3 July 1939, the steam trains which formerly served High Barnet and Edgware were cut back to East Finchley and after March 1941 all trains were diverted to Alexandra Palace instead but this improvement in service was short lived with all through trains being withdrawn and replaced by a limited shuttle.

Through services to Kings Cross were reinstated after the war but were suspended to save coal between 29 October 1951 and 7 January 1952. After local pressure a



Highgate High Level Station in 2008.
Photo by Nick Catford

peak hour only service using Victorian locomotives and ancient rolling stock was reinstated but it was clear that final closure couldn't be held off for long and closure was announced in 1953 as the number of passengers travelling on the line didn't justify its electrification.A shuttle service continued to run until the 3 July 1954 when all stations closed to passenger traffic.

Highgate Station was sited in a deep cutting immediately west of the Highgate East tunnels and when opened in 1867 had two side platforms, with the main station building on the 'down' (south) side at the end of an approach road and a waiting shelter on the 'up side'. A passing loop was provided between the running tracks to accommodate trains that terminated at Highgate. A covered footbridge ran from the upper floor of the entrance building to a brick 'tower' on the up platform adjacent to the shelter.Immediately west of the station the line entered the Highgate West tunnels. In c.1868 an additional entrance was provided high above the station on Archway Road.

The station was rebuilt during the 1880s with a new island platform on the site of the former passing loop, with a new booking office in the middle of the footbridge; the two side platforms and the original buildings were disused at this time. As part of the 1935 'New Works Plan' to incorporate the Edgware, High Barnet and Alexandra Palace lines into the London Transport network the station was once again rebuilt with a new brick platform building. A short section of the 1880s building, including toilets and the canopy, was retained at the east end. New entrances were provided on Archway Road and Priory Gardens on the north side of the line, with a stairway down from the platform to the Northern Line concourse below. No further work on the station took place after the war, with the steam service retained until closure in 1954.

The Sub Brit party about to enter the east tunnel.
Photo by Nick Catford

Highgate now has the distinction of being the best preserved closed station in Greater London. Although the track was lifted in the early 1970s, the platform and station buildings are intact, including the platform canopy. The original side platforms of 1867 are also intact, as is the original timber-faced station building.

Highgate west tunnel; this is what we would have seen had we been able to get in. Photo by Nick Catford

The line between Finsbury Park and the south portal of Highgate East tunnel was reopened in 1984 as a footpath and cycleway called Parkland Walk. Parkland Walk continues a short distance beyond Highgate West tunnel, but the tunnels are securely grilled and the deep cutting and station remain the property of Transport for London; the whole area is surrounded by a high fence with no public access.

There is still direct access onto the platform with stairs up from the Northern line concourse but our point of entry was a narrow gate alongside the station entrance in Priory Gardens. Having collected the keys from the station, 40 Sub Brit members made their way up onto the platform. Until recently the site was heavily overgrown, but following tree and shrub clearance early in 2007 the station is now easily seen.

The platform buildings built in 1940/1 for the Northern Line trains that never came are largely intact although in recent years they have been painted brown. On the wall, the positions of the London Transport roundels are still clearly visible. The waiting room windows have lost their glass but this was removed after closure to avoid later

vandalism. In the middle of the platform, steps lead down to the Northern Line concourse which is immediately below the high level station. There is a staff mess room at the bottom of the stairs and staff using this room can look out of a window up the stairs to the abandoned station. Both side platforms also remain intact, as does the original 1867 station building which stands on the up platform and is now a private residence. The track bed at the west end of the station has been infilled to platform level and above the Northern Line concourse, corrugated metal sheeting has been placed across the track to prevent water seepage onto the concourse below; this has been a serious problem in the past, especially before the undergrowth was cleared.

Most of the cable runs built for the electrification are still in place along the side of the cutting. Both tunnels have been sealed with metal grilles with locked gates; we had keys to both tunnels but the lock at the west end was jammed. We were, however, able to open and explore the Highgate East tunnel.

Highgate is the only disused station on the underground network (albeit not a tube station) where public access is still relatively easy. There are regular public open days and even in recent times a request to the station manager for access has produced favourable results. For a full history of Highgate Station and the abortive Northern Heights scheme see http://www.subbrit.org.uk/sbsites/stations/h/highgate/index.shtml.

From Highgate we caught the Northern Line to Kentish Town for a repeat visit to South Kentish Town Station which was visited on Philip's first excursion on 19 January. With so many more people attending this time, it was decided to repeat this station for those that missed it the first time round. Once again our guide was Camden Town Group Station Manager Margaret Rojugbokan who was clearly impressed by the enthusiasm and knowledge of the visitors. For a full report on South Kentish Town see Subterranea 16.

Waterloo Station

The WW2 railway telephone exchange at Waterloo was located in this room. Photo by Nick Catford

Staying on the Northern Line, we made our way to Waterloo Station to look at some of the voids beneath the main line station; our guide was Ian Liscoe from Network Rail. Unfortunately, essential construction work to provide new access to the underground was underway which limited the areas that could be visited easily, but we saw a number of interesting features including several brick arched rooms that have been used for storage. Within this area a number of brick and breeze block buildings have been erected; these date from WW2 and could have been used as air raid shelters or offices.

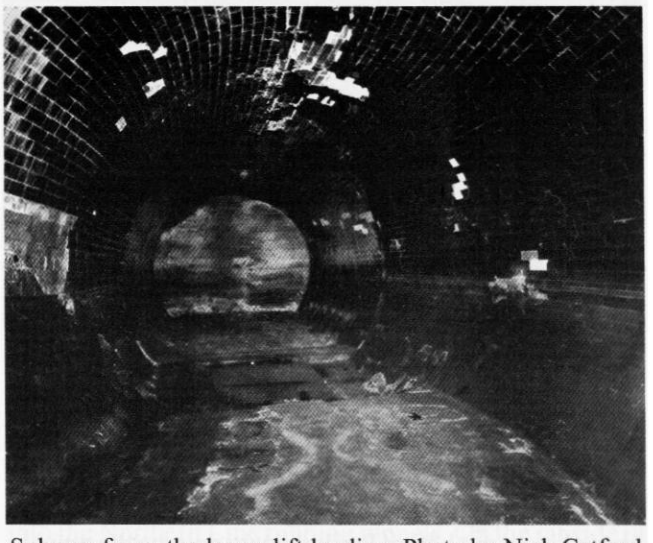
One area that has been used for storage in recent times was originally a railway telephone exchange during WW2 with gas tight doors still in place at the entrance.

We were hoping to see an area that had been described as a first aid post and hospital during WW2 but was in fact used as a marshalling area for troops travelling to Portsmouth and Southampton docks - hence the WW2 vintage signs pointing to toilets etc. However, we didn't get to see it because a key was broken in a lock and despite the best efforts of a number of Network Rail staff the door could not be opened.

Moorgate Station

From Waterloo, it was back on the Northern Line to Moorgate Station which has a complex and interesting history. Although the station has never been closed it has a number of abandoned parts linked to the abortive Lothbury extension to the Great Northern and City line in 1902 and the modernisation of the station between 1922-1924.

City & South London



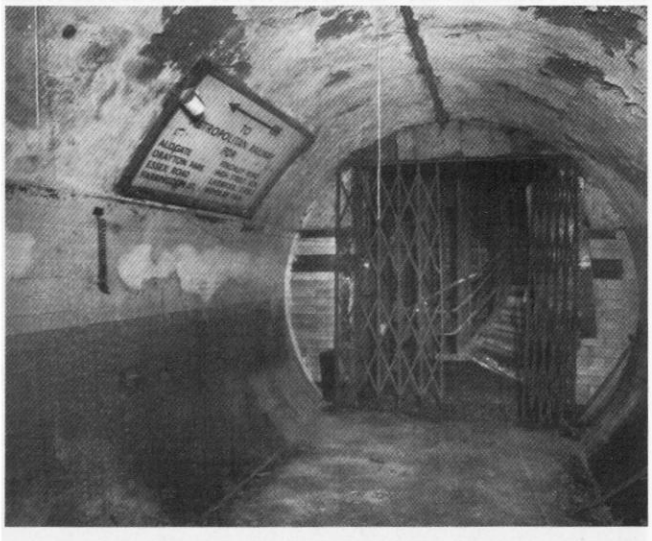
Subway from the lower lift landing. Photo by Nick Catford

The City and South London Railway (C&SLR) opened between Stockwell and King William Street on 18 December 1890 and the new line was an immediate success, with an average of 15,000 passengers a day; it was difficult for the new terminus at King William Street to handle that volume of traffic. Because of its position it was not possible to extend the line and in 1891 a Bill

was put before parliament for a 'branch line' leaving the existing line short of King William Street station and running to the Angel via Bank and Moorgate Street.

The Bill failed but a further Bill was immediately prepared proposing a new station at London Bridge from where twin tunnels would run under the Thames to a new station at Lombard Street and then on to the Angel. After some delay this Bill was passed in 1893 and in 1895 the company directors agreed to start work on the extension as far as Moorgate Street, with an intermediate station at Bank. Moorgate Street would become a temporary terminus until the line was extended to Angel at a later date.

The original stations on the line had island platforms, but the new stations at London Bridge, Bank and Moorgate Street had two station tunnels at the same level joined by cross passages. At Moorgate Street there was a scissors crossing in a double tunnel just short of the station with a signal box on girders over the line. The three stations were provided with electric lifts. King William Street closed on 24 February 1900 and the extension to Moorgate Street opened the following day, a Sunday. On 17 November 1901 the line was further extended to Old Street, City Road and Angel and on 11 May 1907 the line was extended once again to Kings Cross and Euston.



There are two landings at the top of the emergency stairs. This subway, now blocked after a few yards, led to the sub surface Metropolitan Line platforms. Photo by Nick Catford

In 1913 the C & SLR came under the control of the London Electric Railway (LER) and a Bill was immediately put before Parliament to enlarge the tunnels. This would bring them to the standard of other tube lines in London which were now also under the control of the LER. Some of the tunnels were 10' 2" in diameter whilst others were 10' 6".

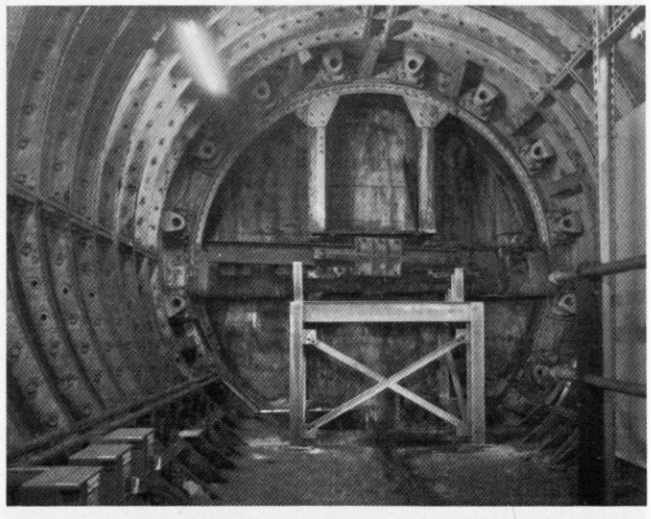
Work on the reconstruction of the line had only reached a planning stage when it was stopped at the outbreak of War in 1914 and didn't restart until the August 1922 when the line between Euston and Moorgate Street was closed. The old tunnel segments were reused, with four extra segments being added giving a slightly irregular shape but close to the 11' 8" underground standard.

The northern section of the line reopened on 20 April 1924 with through trains running between Moorgate (the station was renamed from Moorgate Street on reopening) and Hendon; City Road which had closed with the other stations on the northern section was not reopened. The southern part of the line was reopened on 1 December 1924. Apart from the enlargement of the running tunnels, a number of stations were modernised; all but seven of the stations (including Moorgate) were equipped with escalators and the redundant lifts and associated subways were taken out of use.

The Great Northern & City Railway and the extension to Lothbury

The Great Northern & City Railway was intended to allow mainline trains of the Great Northern Railway to run from Finsbury Park directly into the City of London at Moorgate. The tubes were made large enough to take a main-line train, unlike those of the other tube railways being built in London at the time. The internal diameter was 16 feet compared with less than 12 feet for the Central London Railway and smaller still for the original City & South London Railway tunnels. However, the Great Northern was lukewarm about the scheme and the GN&CR had to settle for a northern terminus in tube underneath Finsbury Park station.

In November 1901, the Great Northern & City Railway published a notice of its intention to present a private bill to parliament seeking permission for an extension of the company's tunnels then under construction between Finsbury Park and Moorgate. The bill proposed a short, 270yd southward continuation of the line to Lothbury which would become the southern terminus in place of Moorgate Street as originally planned. The bill received Royal Assent on 8 August 1902 as the Great Northern and City Railway Act, 1902.



The Greathead tunnelling shield left in place at Moorgate Station in 1904 when the Lothbury extension of the Great Northern & City Line was abandoned. Photo by Nick Catford

The station was to have been entirely below ground with access to the surface by lift and pedestrian subways to the corners of the junction of Lothbury, Gresham Street, Moorgate and Princes Street. One peculiarity of the scheme was that the running tunnels between Moorgate Street and Lothbury stations were to have been shorter than the platform tunnels at the two stations; meaning that the front of a full length train would have arrived at Lothbury before the end had left Moorgate. The line could not be extended any further south due to the proximity of the City & South London Railway's tunnels under Princes Street. Work began on the Moorgate to Lothbury section but was abandoned almost immediately, with the Greathead tunnelling shield left in place at the end of the southbound tunnel just south of Moorgate station. The line opened to Moorgate on 14 February 1904.

The Great Northern & City Railway (GN & CR) Act, 1907, which received assent on 26 July 1907, granted additional time for the construction of the Lothbury extension but the money could not be raised and no further work was done.

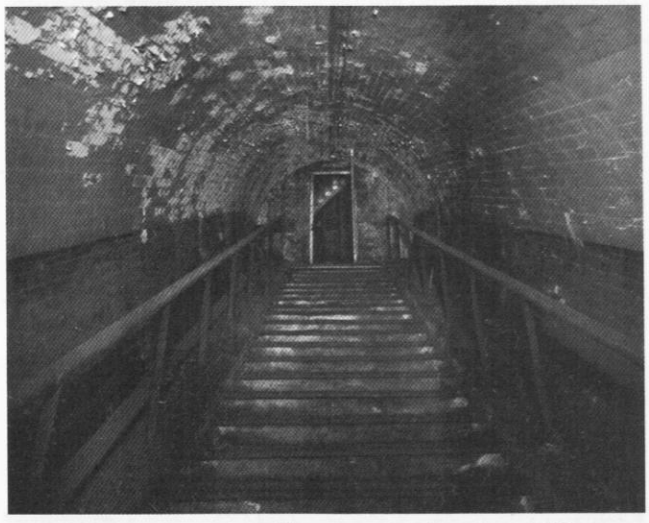
The GN&CR was bought by the Metropolitan ('Met') Railway in 1913; the Met made various plans to link it to some point on the Circle line, but this never came to fruition. The Met also revived the Lothbury station proposal in a modified form as part of a number of plans to connect the GN&CR to the Waterloo & City Railway (W&CR) and the Met itself. When the Metropolitan Railway Act was passed on 15 August 1913, neither of the proposals for connections were permitted, but Lothbury station was allowed, again as the terminus station. In 1914, the Met introduced revised proposals for its connections between the GN&CR and the Met and the W&CR which removed the need for a station at Lothbury. Although these connections were never made, Lothbury station was not revived again.

After the Metropolitan was nationalised (along with the other underground lines) in 1933, the line was renamed the Northern City Line and became part of the Edgware-Morden Line (which became the Northern line in 1937) for operational purposes. As part of London Underground's 'New Works' programme, plans were made to connect the Northern City Line to the surface at Finsbury Park, and then join suburban branches to Alexandra Palace, High Barnet and Edgware as described earlier.

When the 'Northern Heights' plan was dropped after the war, the Northern City Line remained isolated from the rest of the network. Services were cut back from Finsbury Park to Drayton Park in 1964 to make room for the Victoria line to use the platforms at Finsbury Park (low level). In 1970, the line was renamed Northern Line (Highbury Branch). The following year, an agreement was made to transfer the line to British Rail and connect it (as was intended by its original promoters) to the main line at Finsbury Park. By running commuter trains to Moorgate instead of King's Cross, congestion at King's Cross was relieved.

The last London Underground services ran in October 1975 and British Rail services commenced in August 1976. These BR services used the name 'Great Northern Electrics'. The track is now owned by Network Rail and services to Hertford North are provided by First Capital Connect. The name 'Northern City Line' has been revived to refer to the subsurface part of the route.

Tour of Moorgate



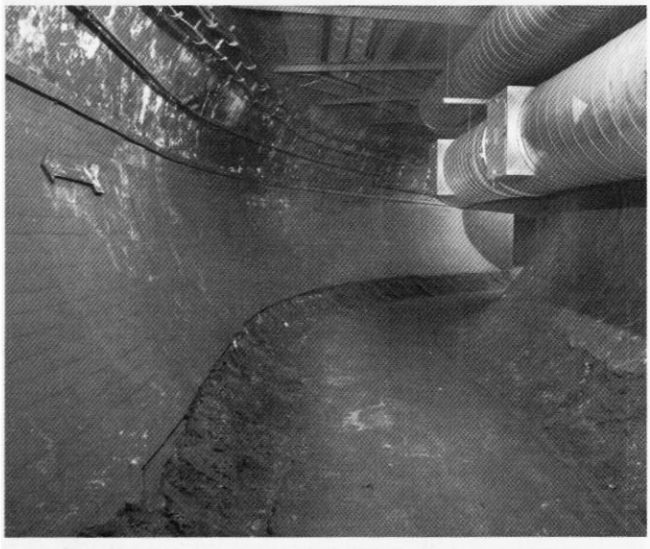
Emergency stairs adjacent to the abandoned lifts
Photo by Nick Catford

Our guide at Moorgate was Customer Service Assistant Martin Davis. From the concourse we made our way down the emergency stairs towards the present 'Great Northern Electrics' platforms. Nearing the bottom of the stairs, a nondescript wooden door on our right opened onto the abandoned subway to the lower lift landing that was taken out of use in 1922; the subway is still used for ventilation and is lit. The white tiled walls are grubby but still in good condition with some signage including 'Way out', 'To the City Line' and 'No Smoking'. There were two lifts shafts, each with two lifts and an emergency spiral staircase. The lifts have been removed but both shafts are open and by looking up it was possible to see the doors onto the upper lift landing. The shafts are still in used for ventilation and one of the lift shafts has been turned into a machinery room with ventilation plant, electrical switchgear and a metal stairway down into the lift well from where a short passage (well grilled!) led into the Northern Line running tunnels. On the far side of the lift shafts, a grimy, unlit subway curves away to the left but is eventually blocked by a brick wall. This subway clearly hasn't been used since the lifts were taken out of service in 1922 and although the brown tiles are still in place, the floor has lifted in places.

Back on the lift landing, a wooden door opened onto another grimy, unlit stairway up to a landing at the bottom of the emergency spiral staircase. The spiral staircase

has been removed and replaced by a new metal stairway which has, itself, clearly been out of use for many years. The stairway goes up to two landings where short subways are blocked at a point where they presumably rejoin the existing subway network, the lower landing led to the sub-surface Metropolitan Line platforms while the upper landing led to the booking office. At the lower of the two landings there is a sign fixed to the tiled wall which says "To Metropolitan Railway for Aldgate, Essex Road, Drayton Park, Farringdon Street, Finchley Road, High Street Ken, Liverpool Street, Wembley Park". Both landings are hot and humid with no through ventilation.

Returning to the current emergency stairs we made our way down to the Northern City line platforms 9 and 10. Both tunnels extend for about 50 yards beyond the station. These tunnels were part of the incomplete extension to Lothbury, which was abandoned in 1903. The station was the site of the infamous Moorgate train crash in 1975 when a southbound Northern City line train ploughed into the buffers beyond the station killing 46 people and injuring 74.



This subway originally led to the Metropolitan line platforms but is now only used for ventilation. Photo by Nick Catford

We made our way along a walkway along one side of the opposite tunnel where, at the end, the Greathead shield was left in place when the extension was abandoned in 1903. The shield is still in situ and is in surprisingly good condition. Just before the shield, a pedestrian bridge crosses the track and enters the Moorgate sub-station which is still in use and was not part of our visit.

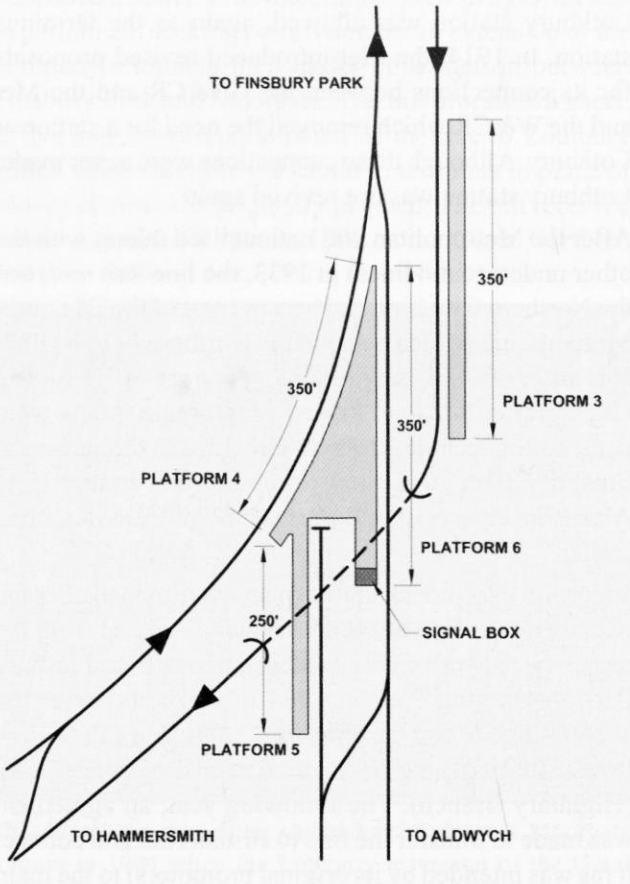
We made our way back along the walkway and just before the platform we turned left into a long abandoned pedestrian subway that once led to the Metropolitan Line platforms. The tiling is very dirty but it was still possible to make out a number of old posters. The subway is now used for ventilation with ventilation trunking suspended from the ceiling at one side.

Part way along the subway there is a vertical shaft. It has been suggested that this was another lift shaft, but it seems more likely it was built for ventilation and there is no evidence of lifts ever having been installed. At the end of the subway there was a large fan filling the tunnel which, luckily, was not working on this occasion.

It was now gone 6pm and we assumed that this was the end of our visit to Moorgate, but Ian had more in store. Having got special permission, we climbed back up the emergency staircase and out on to the sub-surface platforms comprising the Metropolitan Line and the First Capital Connect service to Bedford. We walked along one of the Bedford line platforms and along the track (there is no service on a Saturday!) before descending a ramp below track level. Having passed through a number of low doorways we entered a series of plant rooms on two levels; these contained pumps for de-watering the Moorgate Spring. Our guide jokingly said they were going to bottle it and sell it. After climbing a stairway back up to track level we entered a ventilation plant room with two huge fans for ventilating the Bedford line tunnels. A further stairway led to a tunnel with a small grille door at one end. Passing through the door we found ourselves at ceiling level in one of the underground loading bays beneath the Barbican Centre. A cleaner working below seemed shocked when I emerged into the loading bay high above his head.

It was now after 7pm so we made our way back to Moorgate Station and home after a very enjoyable, albeit tiring, day.

Holborn



Drawn by Tim Robinson

Numbers were a little depleted for the second day; our first station was Holborn on the Piccadilly Line. In 1899 the Great Northern and Strand Railway (GNSR) Act of Parliament authorised a line from Wood Green to Stanhope Street on the north side of Aldwych, an area that was under development following massive slum clearance to the south of Holborn. Stations were to be built at Wood Green, Hornsey, Harringay, Finsbury Park, Holloway, Bingfield Street/York Road, Russell Square, Holborn and Strand (later to be renamed Aldwych).

Platform 6 at Holborn a few days before closure in 1994. Photo by Nick Catford

Finance for the new line was difficult to find and eventually the scheme was taken over by an American sponsor, Charles Tyson Yerkes, who was already financing various other underground railway projects in London, one of which was the Brompton and Piccadilly Circus Railway. Yerkes decided that to make both schemes financially viable they should be incorporated into one line, which resulted in a further Act of Parliament in 1902 to extend the line from Piccadilly Circus to join with the GNSR at Holborn. At the northern end, the line was to be cut back to Finsbury Park and at Holborn the line to Strand was to be built as a short spur. The main line between Finsbury Park and Hammersmith opened on 3rd December 1906

Platform 6 at Holborn in 2008. Photo by Nick Catford

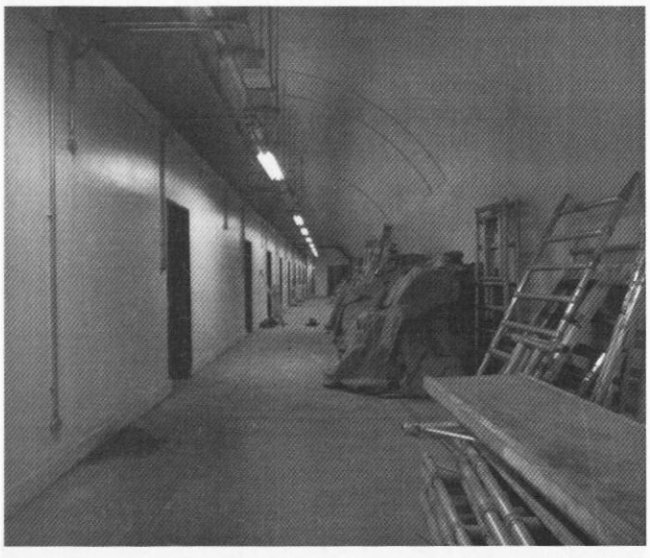
The short section from Holborn to Strand was, however, causing problems. On the surface the London County Council (LCC) were keen that the station should blend in with their new Kingsway development and underground the railway company were unhappy with the track and tunnel layout, which they felt, would prove restrictive. Changes were proposed that required a 3rd Act of Parliament, which was passed on 4 August 1905. The Holborn to Strand line was to become self-contained, with two platforms at Holborn instead of one as originally proposed. A single trailing junction would link the branch to the eastbound main line just north of the station to facilitate stock movements. The second platform would be a shorter bay platform, which would allow two simultaneous services to run between Holborn & Strand.

The branch opened on 30 November 1907, 11 months after the main line. The line was initially worked by a two-car train shuttling in the eastbound tunnel with a second train running in the westbound tunnel during rush hours. Traffic was light from the opening day: bus and tram services in the area were good, both Temple and Holborn Stations were close enough to walk to and the office development in the area did not progress as quickly as expected.

The line still failed to attract passengers and after 1912 the service ran from the eastern platform at Holborn to the western platform at Strand. In 1915 Strand station was renamed Aldwych. Two years later the Sunday service was withdrawn and the eastern line was abandoned altogether and the track was lifted. For many years the disused platforms at Holborn and Aldwych have been used for testing architectural features, paints, tiles, lighting and finishes.

Platform 5 at Holborn in 1995; the platform edge can just be seen on the right side of the corridor. Photo by Nick Catford

During the war the bay platform at Holborn was converted into offices by filling in the track bed to platform level, partitioning the platform into small rooms and constructing two levels with a narrow corridor running along what was the platform edge; the upper level was used as a dormitory. There was also a kitchen and canteen at the southern end of the platform with steps down to the former track bed from the end of the platform. The short section of tunnel between the platform and the junction was used as a workshop. Two separate telephone exchanges (one Post Office and the other London Transport) served the offices. Both were connected to the London Transport automatic telephone system, the Control Office at Leicester Square, the dispersed London Transport Headquarters at Dover Street and the Railway Committee headquarters at Down Street.



Platform 5 at Holborn in 2008; the two-level offices and hostel on the right-hand side have now been demolished but the platform edge can still be seen. The trackbed to the right of the edge line has been filled up to platform level. Photo by Nick Catford

The service between Aldwych and Holborn was suspended during the war with part of the line being used as a deep level air raid shelter and the disused eastbound tunnel used to house treasures from the British Museum, including the Elgin Marbles.

The service resumed on 1 July 1946 with a peak hour service Monday - Friday. Through the 1950s and into the 60s the disused bay platform was used as a staff hostel for people who had lost their homes and more recently has been used as a store for London University.

On 4 January 1993 it was announced that London Underground Ltd. was proposing to close the line because the lifts at Aldwych (which dated back to the line's opening) were worn out and needed replacing at a cost of £3 million. This couldn't be justified with only 450 people using the station each day. The date set for closure was 2 April 1993 but after objections were received this date was put back, with the last train finally running on 30 September 1994, when for the first time in its 87 year history the platforms and the trains were crowded.

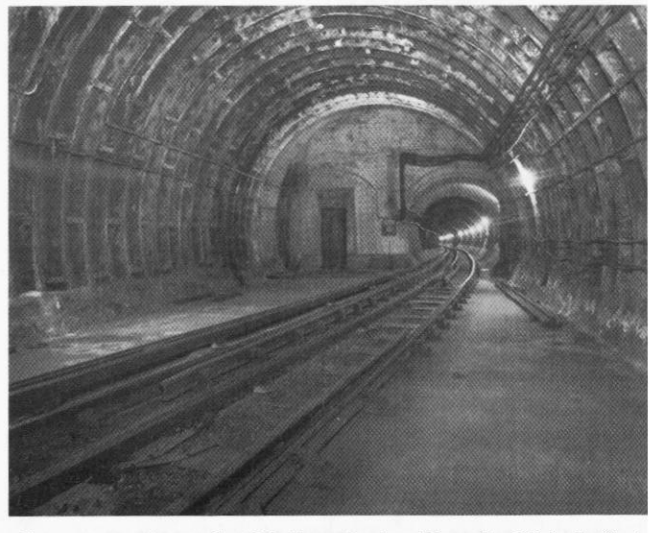
Since closure, Platform 6 at Holborn has been used for testing new materials, signs and finishes and many of the subways now carry a large amount of new cabling. The platform still retains all of its signs and posters and a portacabin has been erected at the end of the platform; this is used as an engineers' store. The line between Holborn and Aldwych is still used by film crews who require a station for a period drama; while the disused Jubilee Line platform at Charing Cross is preferred by film companies who want a modern underground station.

There have however been recent changes to Platform 5 at Holborn. This is accessed through an inconspicuous grey door at the end of Platform 4 from where a short corridor leads directly onto the old bay platform. At the stub end of the bay, one section has been taken over by the National Grid as a sub-station. Moving down the platform, the wartime offices and dormitories above have recently been removed and while the single level offices on the right-hand side remain, they have been repainted. It is still possible to see some of the original features: the green and cream tiles are still in place including the tiled name Holborn on one wall, but much of the tiling has now been painted over. The platform edge is still clearly visible although the track bed has now been brought up to platform level. Beyond this area it is possible to walk through the old workshop and out into the running tunnel.

Tour of Holborn

Having picked up the keys from the station manager we made our way down to Platform 4 on the Piccadilly line from where there was cross platform interchange with Platform 6 for the Aldwych shuttle. For many years after closure the cross passage was blocked by a metal grille, so Piccadilly passengers could see through onto the derelict platform but this has now been replaced by a door.

Although the track is still occasionally used by film crews and a train is stabled in the tunnel between Aldwych & Holborn, the platform is used for the storage of permanent way materials and scaffolding with a portacabin at the



Crossover to the north of Holborn Station. Photo by Nick Catford

northern end. Like Aldwych the station is used to try out new signs etc and at the time of our visit a number of station signs and maps indicated that the station was now on the Central Line, at track level it was still Holborn Station but at higher level it had been transformed into St. Paul's! A small signalbox is still in place at the southern end of the platform.

Stairs lead down to a subway to Platform 3 but this is also blocked at the platform by a new door. Returning to Platform 4 we made our way to the south end of the platform where another door opened onto a narrow corridor with locked rooms either side and at the end of the corridor another door opened onto the long abandoned Platform 5.

When Holborn was last visited by Sub Brit in August 1995 this area was unused and consisted of a narrow walkway with offices on the right-hand side and two levels of rooms on the left-hand side. This area is now in the process of being refurbished; the rooms on the left have now been dismantled and those on the right have been painted including the brown and white tiled walls. In 1995 it was still possible to make out the word 'Holborn' which was fired into the tiles but this has now been painted over. New lighting has recently been installed and it would appear that the platform area is being made ready for some new use.

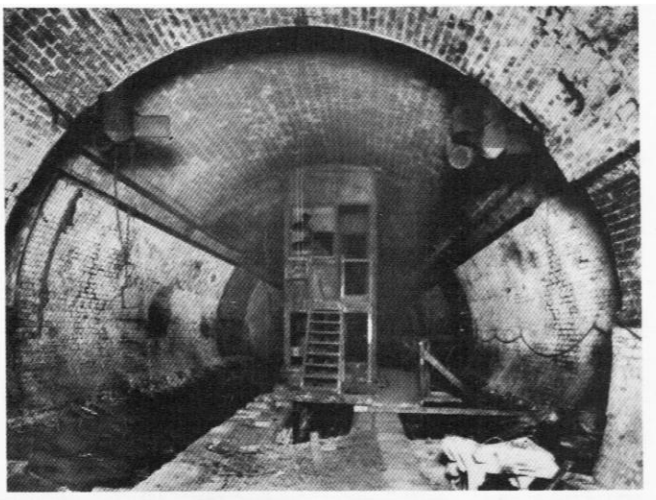
Beyond the platform, there is a heavy gas-proof door and beyond that the former workshop before the tunnel opens out onto the crossover where trains passed over from the east side of the line to the west side before proceeding to Aldwych. The disused tunnel leading to Aldwych is on the far side of the track but as we only had permission to visit Holborn we returned to the surface and made our way to Monument Station on the District Line from whence it was a short walk to King William Street, the last site of the weekend.

King William Street

The early history of the City & South London Railway has already been described.

The old city terminus was most awkwardly placed as regards train running, as it faced almost due west and curved sharply to the left under Swan Pier, crossing the river under the upstream side of London Bridge. There was no intermediate station between King William Street and Borough, which meant that there was no interchange station for London Bridge main line station. In the case of the down line from King William Street this involved a sharp curve and a gradient of 1 in 30 upon leaving the station, while the up line was still steeper, 1 in 14, as the up line had to cross over the down line. This was because of a requirement that the tunnels should run beneath roads and not buildings.

The entrance to King William Street Station was incorporated into an existing building at the corner of King William Street and Arthur Street East (now Monument Street) with the company's offices in the upper floor and the booking hall in the ground floor. The station was 75' below ground and was accessed by two hydraulic lifts within a single shaft; there was also an emergency spiral staircase.



The island platform at King William Street in July 1930. Note the signalbox standing on the platform and the two semaphore signals in the foreground. Photo by Topical Press

Initially, the station was provided with a single track and two side platforms, one for arrivals and the other for departures. This unusual arrangement prevailed because of the original proposal to use cable haulage required a simple track layout.

By the time the 10' 2" the diameter tunnels reached King William Street they were side by side and opened into a single 20ft high by 26ft wide bore, which had a 3ft lining of brick, and was finished in white glazed tiling. A signal box was provided at the Stockwell end.

Construction was difficult with regular subsidence due to the waterlogged ground around the river but the tunnel and station were eventually completed, with the official opening by the Prince of Wales on 4 November 1890 and the public service commencing on 18 December.

The station name could still be seen on the wall tiles in July 1930. Photo by Topical Press

The new line was heavily used from the opening day and the station layout quickly proved unsatisfactory. To overcome this, a Bill was introduced into Parliament in 1882 to construct a new line from Borough to Moorgate Street and abandon the unsuitable terminus. The Bill received Royal Assent in 1883 but this was for a long term solution. To alleviate the congestion problems in the short term, surface facilities were improved by taking a lease on an existing building in Arthur Street East for a Ladies Room, Parcels Room and Left Luggage Office. A plan to install a third lift was dropped because of cost.

With 15,000 passengers using the station daily, improvements were also urgently required at platform level so the single line was replaced by twin lines running into an island platform which was completed by December 1895. A scissors crossing was added at the south end allowing trains to use either line but this required a shortening of the platform which could now only be used by three-car trains.

Work on the extension to Moorgate Street started in 1896 and King William Street closed with the inauguration of the new service from 25th February 1900; the station and the tunnels running under the Thames to Borough were abandoned. Initially no use was found for the tunnels but as early as 1901 it was suggested they could be used for cultivating mushrooms or as a bonded store. The favoured solution was to use the tunnels to carry telephone or electric cables but no user could be found. Initially the track remained in place and was used to store empty stock.

At the outbreak of war in 1914, there were fears that the tunnels might be used by enemy agents and a thorough search was undertaken before the track was removed and the tunnels were sealed up. In 1923 the station was offered for sale or lease and the *Railway Magazine* of September 1930 published a description of the station and its remaining features stating that "*The present means of access is through what was formerly the emergency staircase and this is reached from the cellar under 46 King William Street. Descending this gloomy circular stairway by the light of two acetylene flares our party reached the old platform level although the tracks have been entirely and the platform partially removed. At the platform level the station consists of a circular brick tunnel with a centre platform and the site of the lines on either side. Openings give access to the old lift shaft. The shaft has been covered over and the top portion used by shop premises. Remains of gas fixtures are a reminder that the station was lighted by gas during the first ten years of the railway's existence, electricity being introduced gradually thereafter. The King William Street station names are still in position in two or three places.*

At the end of the platform is the remains of the signal box still containing its 22 hand operated levers. Three of the two-position semaphores are in position. With the original position of signalling the headway of the trains was about 3˚ minutes.

Beyond the station the brick tunnel ceases and the line enters the two iron tubes. Our party proceeded along the left hand tube. The point where the other tube crosses over is easily noticed and the two tracks are connected by an iron ladder. Further on we joined the other tube by a narrow connecting passage on the left and returned to the station. At the mouth of the tubes a much faded board can still be deciphered notifying speed not to exceed five miles per hour".

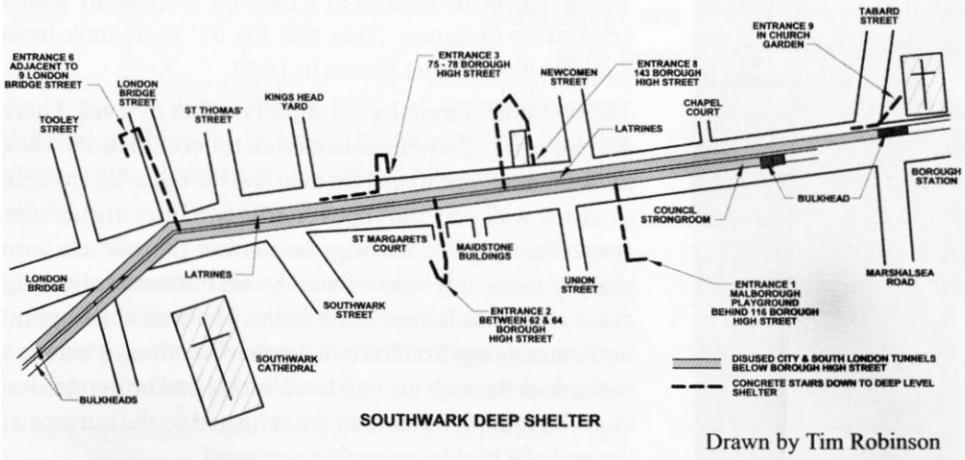
No 46 King William Street was eventually demolished and in 1933 Regis House was built on the site. The 25' diameter lift shaft was filled at this time but access to the former station was retained using the emergency staircase which was reached from the basement of Regis House. There was little change until the outbreak of war in 1939.

The Southwark Shelter

On 11 November 1939, it was reported in the Evening Star that work would start to convert the running tunnels but not the station itself into a deep level public air raid shelter. The work, which was expected to last three months, would include the construction of eight entrances, air conditioning plant, seats and first aid posts. This announcement was somewhat premature, but the Minister of Home Security had approved Southwark Council's proposal in principle. A rent of £100 per year was agreed with the London Passenger Transport Board and work started on conversion of the tunnels into a deep shelter for 8000 people in January 1940.

The first entrance at Marlborough Yard at the rear of 116 Borough High Street was available for use at the beginning of August 1940. The shelter ran between two concrete bulkheads that had been installed in the tunnel at the time of the Munich crisis in 1938; one was just north of the junction with the Moorgate line at Borough and the second was just south of the River Thames which was fitted with a watertight steel door. A similar bulkhead was built on the north side of the Thames. The bulkheads were built to ensure no flooding of the tunnel would take place if the tunnel under the river was breached by a bomb. A strongroom was built on the down side of the line just north of the Borough bulkhead to house Council valuables and important documents.

Each new entrance staircase was built using reinforced concrete segments and would allow a flow of 300 people a minute. Concrete staircases were built inside the tunnels with a void beneath the steps for ventilation, electric cables and water services. A new concrete slab floor was laid in the running tunnels, again leaving a void for services beneath. Some wooden seating was provided on both sides and 12 banks of toilet cubicles were built at intervals along both tunnels. Electric lighting was provided throughout and the walls were whitewashed and at a later date some bunks were fitted.

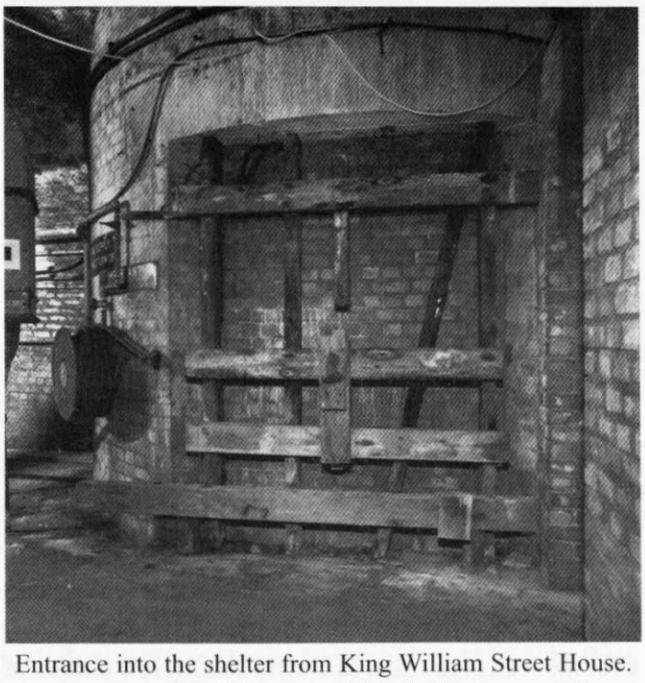


SOUTHWARK DEEP SHELTER

Drawn by Tim Robinson

The shelter came into use on 24 June 1940, six days after the start of the blitz and by August that year thousands of people were sleeping in the tunnel every night even when no air raid warning had been sounded.

King William Street station wasn't part of this scheme. The Southwark shelter occupied the complete section south of the River Thames and the under river sections were isolated by the concrete bulkheads and watertight doors either side of the river. This left the brick-lined King William Street station tunnel and crossover tunnel plus the cast iron running tunnels down as far as the bulkheads beneath Upper Thames Street.



Entrance into the shelter from King William Street House. (1995) Photo by Nick Catford

Early in 1940, the owners of Regis House secured a tenancy to use the station tunnel and the crossover tunnel as an air-raid shelter. Various works were required to convert the tunnel to its new use. A mezzanine floor of reinforced concrete was constructed to provide twice the area for use as a shelter. A new floor at track level was also laid. Electric lighting was installed together with two blocks of toilets in the old running tunnels, a kitchen and emergency forced ventilation. An additional 10' 6" diameter shaft, 64 feet in depth, was sunk in Arthur Street with direct access from the basement of King William Street House (on the opposite side of King William Street from Regis House). This connected with the south side of the former crossover tunnel, a short distance from the point at which the two separate running tunnels started. The whole works then formed a private shelter for the office employees of Regis House and King William Street House with the two basement access points. The capacity was stated to be 2,000 persons.

The tenancy was continued after the war so that the tunnels could be used for storage. When visited in the 1970s the station was still being used for document storage by Regis House. Regis House was demolished at the beginning of 1995 and subsequently replaced by a new building of the same name. Access was still retained at the new Regis House. A blue plaque can be seen in Monument Street which reads "Site of King William Street Underground Station. First City Terminus (1890 - 1900)".

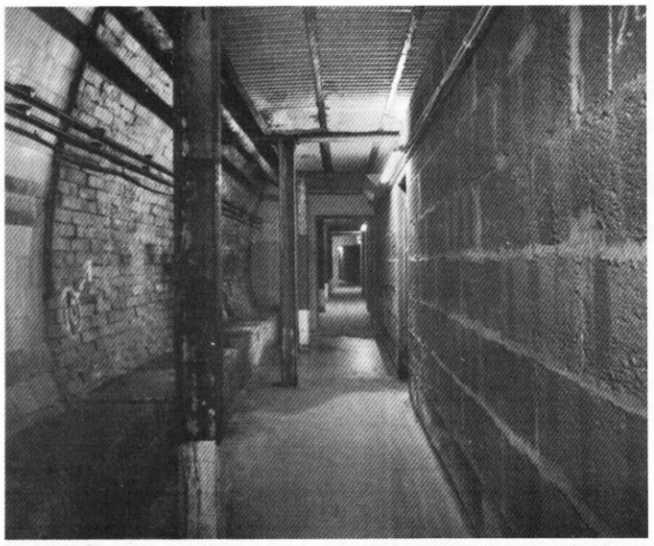
During the building of the Jubilee Line Extension in the 1990s a new use was found for the old running tunnels between London Bridge and the river; they have now been adapted as part of a ventilation system for the Jubilee Line. This has involved building new concrete bulkheads which has effectively cut the tunnel in two and through trips between Borough and King William Street are no longer possible. This work has cut the through ventilation and the tunnels and especially the spiral stairs are now very humid. In recent years new lighting has been installed at King William Street and the station and west running tunnel now carry new cabling for the underground network.

Tour of King William Street

For many King William Street was the highlight of the weekend and with more than two hours to explore this historical site we made the most of an opportunity that probably won't be repeated.

From the basement of Regis House we passed through a door onto the top of the old emergency stairs which descend 75 feet to the station below. The stairs appear to be original and in good condition considering their age. The spiral ends 30 feet above the platform from where a concrete stairway runs down to platform level; this still retains its original cream and patterned tiling scheme employed on the early CSLR stations.

The two-level rooms constructed in 1940 remain largely unaltered, running along the east side of the station tunnel. Steps at either end of the block of rooms lead to the upper



Looking east in 1995, the trackbed was filled up to platform level when the station was converted into an air raid shelter. Two-level shelter rooms can be seen on the right with some original wall tiling on the left. Photo by Nick Catford

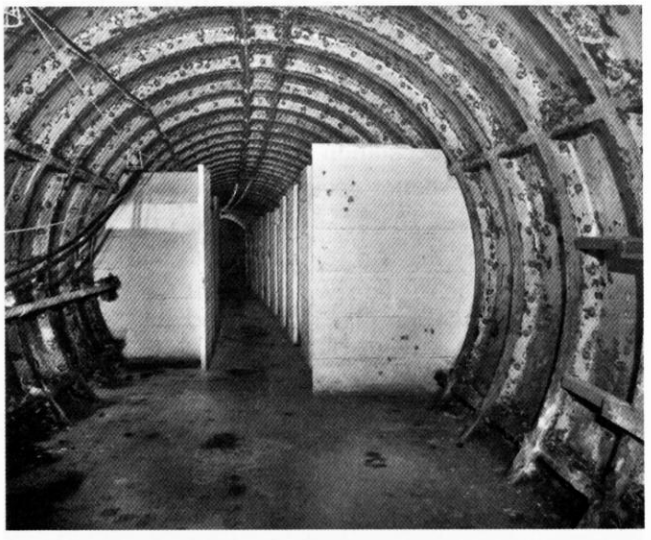
level where some ventilation plant can still be seen. Metal trunking is suspended from the ceiling in both the upper and lower rooms. Previous visitors have noted a number of WW2 propaganda posters still in good condition but these have all now been removed, perhaps when new cables were fitted recently. It is still possible to make out a couple of the poster fragments including one that once said "Careless talk costs lives". One typed sheet is still in place which says "Special notice to late arrivals and early risers: please spare a thought for your fellow shelterers and refrain from making any unnecessary noise. Please remember others may be asleep although you are not".

At the east end of the station there is a side room, perhaps a toilet, that still has tiled walls and a tiled ceiling. A walkway runs along the south side of the station where some tiling is also still in place on the wall. At the end of the 'building', on the site of the crossover at the end of the platform, there is a kitchen with a serving hatch close to a small fan which feeds into the ventilation trunking.

The upper level of the shelter. (1995) Photo by Nick Catford

There is also the bottom of a circular brick shaft with a bricked-up entrance. This was the 64' shaft sunk from King William Street House in 1940.

The two tunnel mouths are slightly offset in level. There are two rows of whitewashed brick toilet cubicles in each tunnel mouth, one tunnel for men and the other for women; a narrow walkway runs between the two lines of cubicles. Immediately after leaving the station the tunnels turn sharply to the left below Swan Street before terminating at a concrete bulkhead close to the Thames; at this point both tunnels are flooded to a depth of one foot. There is a metal door through the bulkhead but we had no permission to go beyond this point so we returned to the surface at the end of a highly enjoyable weekend.



Toilet cubicles in the running tunnel beyond the station (1995) Photo by Nick Catford

Philip is hoping to arrange further visits to other stations later this year or early next year which will be notified to members via the email list. It should be noted that this was not an 'official' Sub Brit trip; it was a private trip arranged by Philip Lindhurst but made available to Sub Brit members through the e-mail list.

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Sub Brit on Mendip

Bob Templeman

On Friday 18 July 2008 a party of seven members gathered on Mendip to visit Charterhouse on Mendip where some of the most important remains of ancient mining in Western Europe are to be found.

Lead on Mendip was found near to the surface in long narrow horizontal veins - known locally as rakes - with its greatest concentration in the Charterhouse valley. Thus it was easy to initially exploit, by simple digging or indeed picking it up from the surface.

Mining operations spanned the pre-Roman era, through Roman, medieval, Tudor and finally early modern times. The earliest exploitation commenced with the digging of trenches to expose the veins of lead ore, and the digging out of the entire lode or rake. This was followed by the construction of conventional shafts and later the ill-fated period of Cornish miners sinking deep shafts to find non-existent lead below the previous workings. Latterly the resmelting of the existing slag heaps and slimes resulting from previous workings has taken place. Pre-Roman activity has been confirmed with the finds of lead weights for fishing nets in the vicinity of Glastonbury Lake village together with the discovery of two British silver coins at Charterhouse.

The mining activity of the Romans has been well documented following various archaeological excavations, together with the finds of 19 or so inscribed lead ingots or pig weighing from 34.5 kilograms to 101 kilograms. The furthest away discovery was made at St Valery-sur-Somme. Whilst no evidence of the Roman name for Charterhouse has been found, some of the inscriptions on these pigs contain the letters VEB possibly a reference to Charterhouse. Romans usually abbreviated inscriptions and VEB might just stand for (Great) Wemberham, a few miles away, where a Roman Villa has been discovered.

Over two days various archaeological sites of the valley were visited as detailed below:

Lead condensing flues

These were probably built circa 1867-73 by Treffry's Company who may have enlarged existing flues belonging to the Mendip Hills Mining Company, which had also built flues at Charterhouse 1 mine before 1861. The flues were in use until 1878. Dressed materials, slags and slimes – that is fine-grained ore and mud as recovered from the dressing floors – were smelted in reverberatory Castilian furnaces in which fans driven by a steam engine forced hot air over the slag. The vaporised lead collected in the flues and was subsequently removed by hand. There were two sets of flues, each with four tunnels. The flues survive as partially roofed limestone rubble structures. Blocking walls in some of the tunnels date from 1939-45 when they were used for storage in the Second World War.

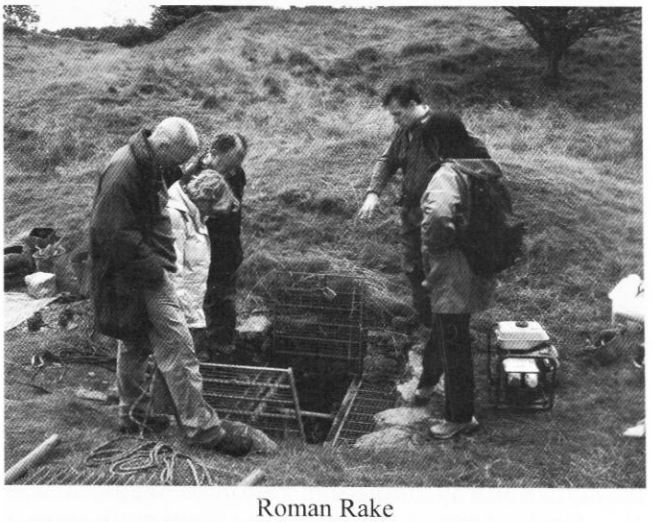
Bleak House and adjacent tenements

These are now no more than earthworks and ruins. Bleak House was the residence of the manager of the Charterhouse Lead Mines.

Pattinson plant and stables

In October 1833, a Mr Hugh Lee Pattinson patented a process involving the extraction of silver from lead by allowing molten lead to crystallise while pouring off still molten silver-rich lead into separate containers. The plant at Charterhouse may date to 1858 when 36.7 kg of silver was recorded to have been produced.

All that remains today are the foundations. The plant consisted of a range of four rooms, with a flue running northwards up a slope behind the buildings to the site of a chimney. The rubble from excavations of 1967-68 was inadvertently bulldozed during the rebuilding of the causeway breached in the 1968 flood. Lying nine metres to the north west of the plant, an openfronted stable was excavated between 1968 and 1970.



Roman Rake

Roman Rake

Seen here is the site of an archaeological dig where the excavation of a long narrow rake similar in character to other known Roman mines. Five trenches were excavated which showed the rake to be the surface of narrow cuts down into the limestone for a great depth. At some point a natural cave system was encountered. The filling-in of the top of these fissures could be firmly dated to the second half of the first century AD and was probably associated with the digging of other rakes. The site is now a caving dig.

Barwell Shaft and adjacent horse whim

Barwell is a typical deep square Cornish mine shaft, now filled in. The circular floor of the whim (a local name for a horse gin) is to be found over a dry stone wall. The

horse whim winding engines of Charterhouse were apparently able to raise loads of up to 150 kg.

Stainsby's Shaft

This is another Cornish mine shaft, originally 108 metres deep and gradually filled in having fallen into disuse. The existing 10 metre shaft with large visible shotholes is now the site of a caving dig.

Grebe Swallet

This was discovered after the great flood of 1968 and is a swallet (a natural sink hole/entrance to cave system). It was utilized by 18th century miners as a lead mine

Waterwheel Swallet

This was also uncovered after the great flood of 1968 and was found to contain the remains of a six metre diameter water wheel together with its associated gearing. Current thinking is that it was the power source of a saw mill.

Additional Sites

Shute Shelve Tunnel

The opportunity was also taken to walk through a former railway tunnel under Shute Shelve hill. Part of the Great Western Railway line from Yatton to Wells, it was completed in 1869 and finally closed in 1965. The tunnel is now used both as a footpath and cycle route. The tunnel is unusual in that the southern half is unlined whilst the northern portal and section is brick lined with appropriate refuges for gangers.

Finally, we had the good fortune to be able to visit and see the Mesolithic attributed engravings in Aveline's hole, Burrington Combe. These were discovered in 2003, following the discovery of Palaeolithic cave art at Church Hole, Cresswell Crags earlier the same year. The engravings comprise a lattice work of two rows of engraved crosses, six in the upper row and four in the lower row, measuring approximately 25 cm wide by 20 cm high.

Acknowledgements:

GJ Mullan and LJ Wilson for the visit to Aveline's hole

The Mendip Caving Group, for use of their Cottage

References:

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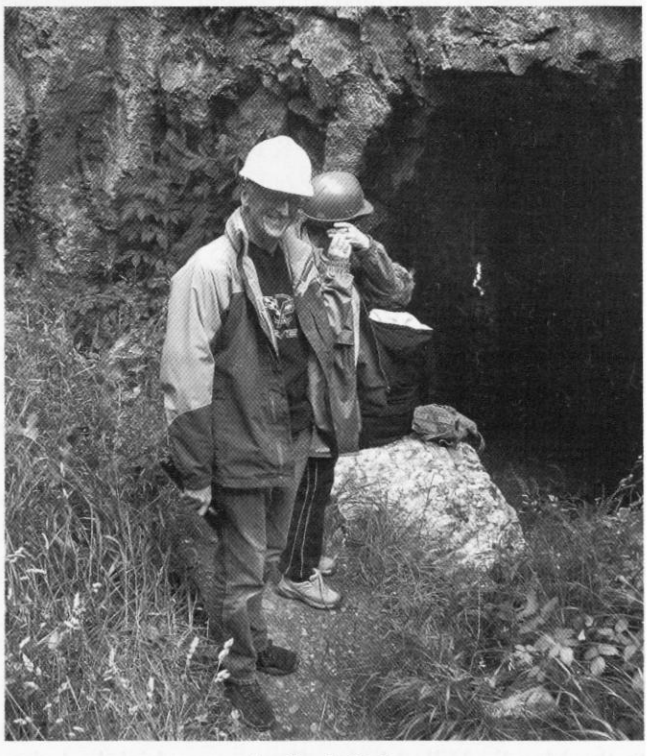
Cornish Miners at Charterhouse-on-Mendip by WI Stanton and AG Clarke, from the proceedings of Bristol Speleological Society, 1984, Vol 17 No1, pp29-54.

A possible Mesolithic engraving in Aveline's Hole, Burrington Combe, North Somerset, by GJ Mullan and LJ Wilson.

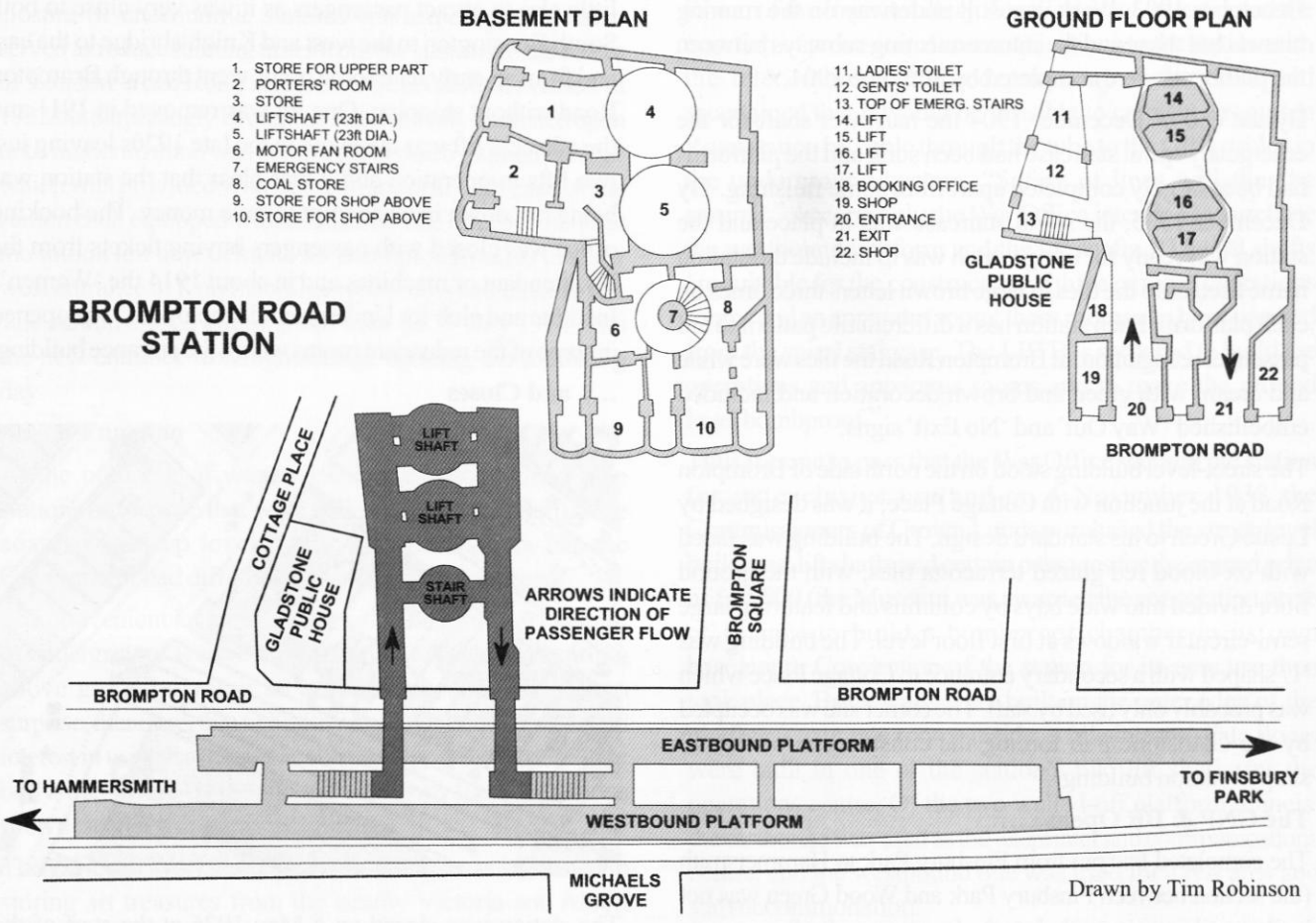
All Photos by Bob Templeman.



Aveline's Hole

Brompton Road Station and London's Anti-Aircraft Defences

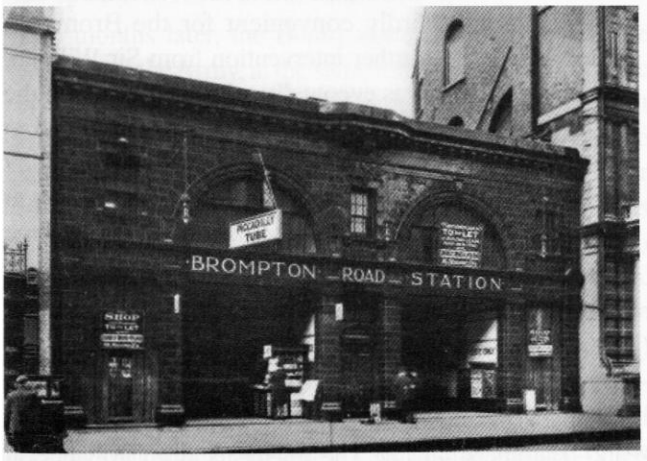
Nick Catford and Andy Emmerson



Drawn by Tim Robinson

Brompton Road had a brief and undistinguished life as a station on the London Underground but during WW2 the redundant station was given a new lease of life and played a strategic role in the Capital's defences against the German Luftwaffe.

During the early years of the development of London's underground rail network, the Brompton & Piccadilly Circus Railway was one of the first to receive parliamentary sanction on 6 August 1897, when the company was authorised to build an electrified line between Piccadilly and South Kensington with five intermediate stations at Dover Street, Down Street, Hyde Park Corner, Knightsbridge and Brompton Road. Unfortunately the company was unable to raise sufficient finance and work on the construction never started. In 1899 financial problems forced the delay of another venture proposed by the Great Northern & Strand Railway to build a line from Wood Green to Aldwych.



The street level building in 1907, a typical Leslie Green frontage.

Both lines were eventually revived under the direction of the American capitalist Charles Tyson Yerkes who had played a major role in developing mass-transit systems in Chicago. In 1900, Yerkes decided to become involved in the development of the London Underground network and quickly took control of the Metropolitan District Railway and the unbuilt Baker Street & Waterloo Railway, Charing Cross, Euston & Hampstead Railway and the two ailing schemes which he combined as the Great Northern Piccadilly & Brompton Railway.

Two further parliamentary Bills were required to sanction an additional length of line linking Aldwych with the B & PCR's proposed terminus at Piccadilly. The two companies merged on 8 August 1902 and the Great Northern Piccadilly & Brompton Railway was officially formed on 18 November that year.

Construction

Construction started at Knightsbridge in July 1902 and soon work was underway along the whole length of the route. At

Brompton Road, the two station tunnels each 21' 2 °" in diameter and 350' in length and two 60' 3" deep lift shafts (each accommodating two lifts had been finished by December 1903. Work was still underway on the running tunnels but these and the interconnecting subways between the platforms were completed by 30th June 1904.

By the end of December 1904 the narrower shaft for the emergency spiral staircase had been sunk and the platforms had been largely completed apart from some finishing. By December 1905, the spiral staircase was in place and the station was ready for tiling which was to include the station name fired onto the tiles in large brown letters three times on each platform. Each station has a different tile pattern to aid passenger recognition: at Brompton Road the tiles were white and cream with green and brown decoration and included embellished 'Way Out' and 'No Exit' signs.

The street-level building stood on the north side of Brompton Road at the junction with Cottage Place; it was designed by Leslie Green to his standard design. The building was faced with ox-blood red glazed terracotta tiles, with the ground floor divided into wide bays by columns and featuring large semi-circular windows at first floor level. The building was 'L' shaped with a secondary entrance in Cottage Place which was probably only used by staff. The corner site was occupied by the Gladstone pub forcing the construction of the 'L' shaped station building.

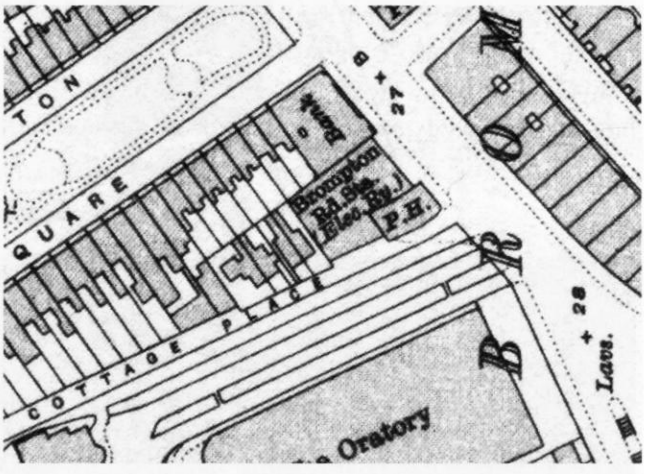
The GNP & BR Opens.....

The completed line ran from Finsbury Park to Hammersmith (the section between Finsbury Park and Wood Green was not built until very much later). It was ready for use on 3 December 1906 and after passing a Board of Trade inspection was ceremonially opened by David Lloyd George (MP) on 15 December a year after Yerkes' death. Brompton Road opened with the line although three of the intermediate stations, including Down Street, were unfinished and didn't open until the following spring. A short branch between Holborn and Strand (later renamed Aldwych) opened on 30 November 1907. On 1 July 1910, the GNP&BR and the other Yerkes - owned railways were merged by private Act of Parliament to become the 'London Electric Railway Company'.

Underground Electric Railways Company of London Limited red 'roundel' on Brompton Road platform in 1923.

From the outset, Brompton Road failed to attract many passengers; it was conveniently sited for the Brompton Oratory and the Victoria & Albert Museum but there was little else to attract passengers as it was very close to both South Kensington to the west and Knightsbridge to the east and from an early date some trains went through Brompton Road without stopping. One lift was removed in 1911 and the adjacent lift was taken out in the late 1920s leaving just two lifts in operation and it was clear that the station was being run down in an attempt to save money. The booking office was closed with passengers buying tickets from the lift attendant or machines and in about 1914 the 'Women's Institute and club for Underground employees' was opened in some of the redundant rooms within the entrance building.

..... and Closes



The station was closed on 4 May 1926 at the start of the General Strike but when other stations reopened, Brompton Road (and York Road north of Kings Cross) remained closed. The company hoped that the station could remain closed but Brompton Road got a reprieve after local MP William Davidson made an appeal in the House of Commons to the Minister of Transport to have the station reopened stating that local residents and traders were badly inconvenienced as were those wishing the visit the nearby Brompton Oratory and the parish church. The Minister assured the Honorable Member that the station would be reopened.

The station did indeed re-open on 4 October 1926 without a Sunday service (hardly convenient for the Brompton Oratory!) but after further intervention from Sir William, the Sunday service was eventually reinstated although the reprieve was to be short lived. Many trains continued to pass through Brompton Road without stopping and by 1929 alternate trains weren't stopping during the week although at weekends most trains called at the station apart from some early afternoon and late night services.

Final Closure

The early 1930s was a time of recession and in order to relieve unemployment Government capital was made available to extend the tube network including the Finsbury Park – Hammersmith line. The scheme included an extension

northwards to Cockfosters and westwards to Hounslow and Uxbridge.

As part of the modernisation and expansion programme the closure of uneconomic stations was expected. This also served to reduce running times from the suburbs to the centre of London. York Road and Down Street stations closed in 1932 but surprisingly Brompton Road initially remained open until modernization was completed at nearby Knightsbridge which was provided with new entrances at both ends of the station each equipped with escalators. The improvements at the station left little demand for Brompton Road as the new west entrance at Knightsbridge reduced its catchment area. The station closed after the last train on 29 July 1934 with the new entrance to Knightsbridge opening the following day.

A New Function

At the outbreak of war in 1939, many abandoned tube stations (and those that were still under construction) were adapted as deep level public air raid shelters but the Government had different plans for Brompton Road.

The convenient location of the station with its combination of underground accommodation and a two-storied building above ground made it an attractive location. It was no surprise, therefore, that two government departments showed interest in using it as secure accommodation, but since neither body was aware of the other's intentions the negotiations soon descended into tragic comedy.

The Office of Works and Public Buildings was interested in storing art treasures from the nearby Victoria and Albert Museum there, whilst the War Office had other designs on the place. Ostensibly His Majesty's Office of Works had prior claim, having negotiated with the LPTB (The London Passenger Transport Board took over the London Electric Railway Company in 1933) to use the tube station. Independently, the Commander 1st Anti-Aircraft Division, Territorial Army, had held a meeting with the LPTB on 24 May 1938 with a view to locating the Inner Artillery Zone gun operations room (GOR) in the lift shaft of a disused station. Brompton Road was ideal since the building above the station could serve as quarters for the personnel manning the operations room in war conditions.

Two months later, the Board agreed to lease or sell the property to the Army, at the same time confirming a licence to the Victoria & Albert Museum assuming that joint occupancy would not cause problems. This wasn't to be however and when word reached the Museum in September 1938 that the station might be needed for storing explosives or ammunition, it complained that this would make the station totally unsuitable for safe storage of national art treasures. An immediate refutation from the War Office stated its sole intention was to use the premises as Operations (Control) Room for the guns of the Inner London Defences, 1st Anti-Aircraft Division and a subsequent letter to the Office of Works apologised, but the scheme had to proceed in the interests of national security.

In justification, the OC (Officer Commanding) 1st AA Divisional Signals stated, "Brompton Road station is ideally situated and a most suitable site for the Gun Operations Room of the Inner Artillery Zone". He had investigated the question of provision of communications to the station with the telecommunications department of the GPO and ascertained that it would be possible to connect Brompton Road station by cable through the tube to the GPO cables in the underground system. "Safety of lines will thus be assured." Accordingly the War Office intended to purchase the westbound platform and the lift shafts. "The lift shafts are suitable for the construction of three or more operations rooms and an apparatus room; these rooms can be connected from the spiral staircase. The LPTB is prepared to build the operations and apparatus rooms and to make the ground level bombproof."

Thus it came to pass that the War Office secured the station for its exclusive use and on 4 November 1938 the Commissioners of Crown Lands purchased the street-level buildings, lift shafts and certain passages for the agreed price of £24,000 (the Museum was awarded the consolation prize of finance to build a bombproof chamber in its own basement). Conversion of the station for its new use then took place. Brick walls were built on the outer edge of the platforms to create rooms inside, while intermediate floors were built in one of the station's two lift shafts for the operations centre. Of the two walled-off platform tunnels, the eastbound was used as the teleprinter and communications centre, and the westbound one was used for a rest area and staff accommodation.

Throughout the war, the station was the HQ of 1st Anti-aircraft (AA) Division, whose area of responsibility was London and its environs. London Gun Defended area (GDA) was divided into three areas called 'Inner Artillery Zones' (IAZ). These were IAZ South, south of the Thames, IAZ North and IAZ East. In addition there was a "Slough and Langley Group" which covered aircraft production in these areas. Normal Administration was devolved through the usual military channels; however the Division was under the operational control of the RAF, in this case the Air Officer Commanding (AOC) No 11 (Fighter) Group, RAF at RAF Uxbridge, who exercised control over all of the southeast. This included Fighter Squadrons, Barrage Balloon Squadrons and 1st and 6th AA Divisions.

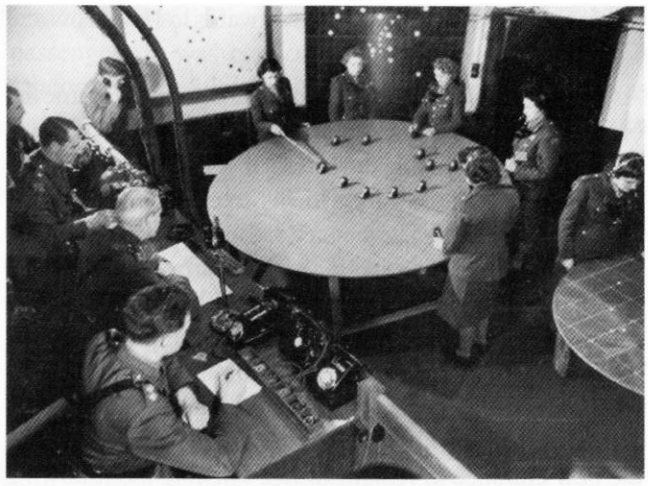
Anti Aircraft Operations

All information received from radar stations, ROC Group HQ's and other services, that was plotted on the RAF Group operations table was copied to the AA HQ at Brompton Road and displayed on their own plotting tables. Later AA gun sites had their own radar, which enabled them to track enemy aircraft locally.

Guns could not engage until permission had been granted by the RAF Group, Commander. The AA HQ was in direct telephone contact with all gun sites via an open multiphone system.

The plotting room staff were members of the Auxiliary Territorial Service (known as the ATS) which was the women's branch of the Army. Many ATS worked in AA Command they also manned the control instruments at the gun sites. They did not (officially) 'man' the guns.

A vivid impression of day-to-day operations in 1943 is given by retired Lt. Col. B. N. Reckitt in his book *Diary of Anti Aircraft Defence 1938-1944*. He explains that the original operations room of 1939 was on the ground floor of the street level building. Although later used only as an office, it retained its original plotting maps and was kept in that state for the edification of distinguished foreign visitors to whom it was impolitic to show the real methods of control. The operations rooms actually used for most of the war were at a lower level, built one above the other in one of the station's former lift shafts. He continues, "The top room of the lift shaft was called GOR I (Gun Operations Room I), the room of the General Officer Commanding (GOC) who had the picture of the progress of a raid plotted on a large map table below the dais and where he was in touch by telephone with the RAF, ARP and Fire Services, with the searchlights and with every gun site. An elaborate system of coloured lights showed which were actually firing, provided always that the telephonists on the sites remembered to 'key-in' the appropriate code. Their forgetfulness was a continual source of trouble with the GOC.

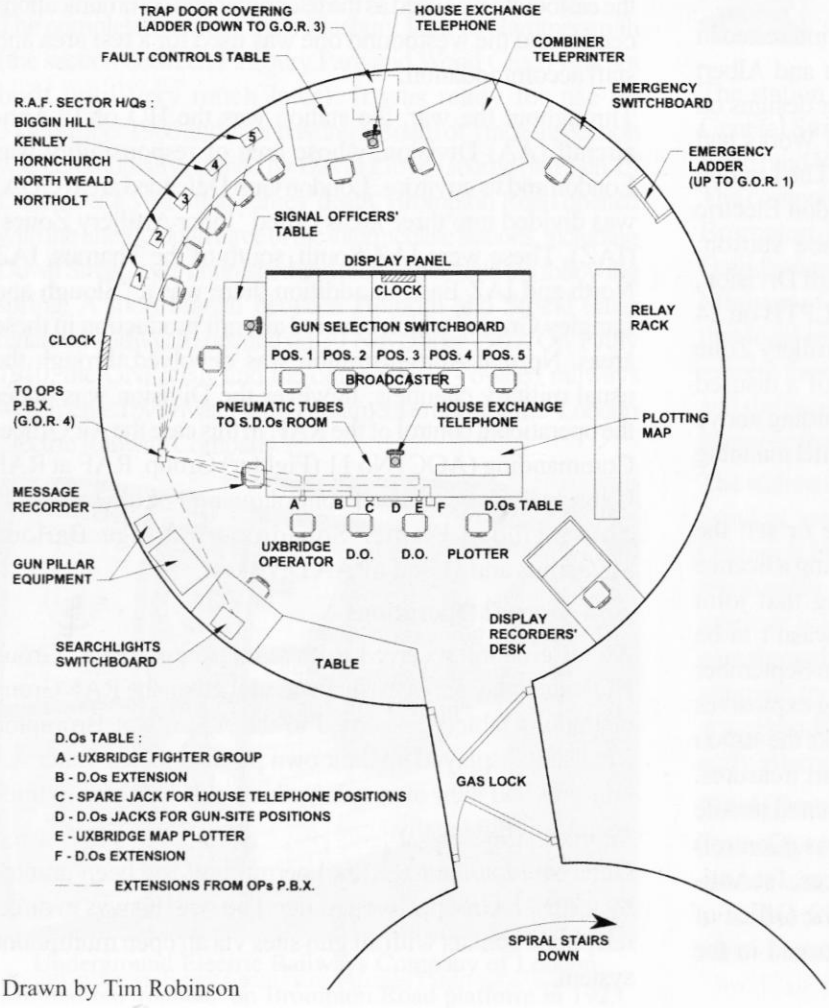


Operations room of the 1st Anti Aircraft Division in the lift shaft (GOR I) at Brompton Road. Women of the Auxiliary Territorial Service (ATS) plotting aircraft movements enabled the army officers on the dais to command firing at remote artillery gun sites. Although functionally part of the army, Anti-Aircraft control came under the operational control of RAF Fighter Command.

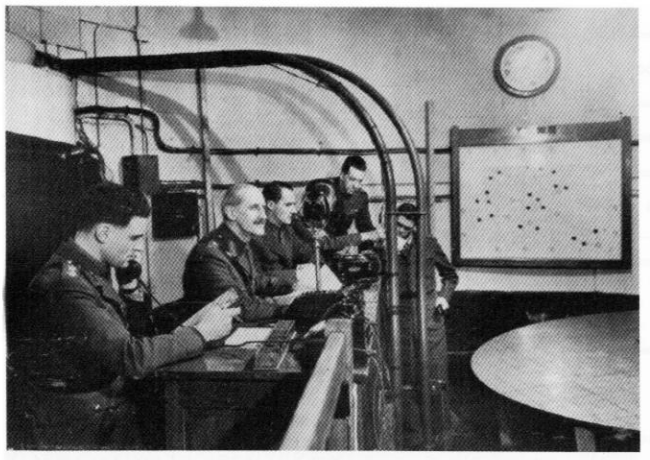
GOR II was mainly a telephone exchange and centre of information for intelligence officers. GOR III, deeper down in the lift shaft, controlled the northern London area and below it GOR IV the southern area and each of these two was in the charge of a Regimental Commander drawn from the respective areas on a rota basis, by night. In each room, the progress of a raid was plotted on maps as in GOR I. The main job of the controller was calling out the gunners for action, plotting the courses of enemy aircraft to them, directing their radar sets to search on the bearings of approaching raiders and ordering 'barrages' in the event of saturation attacks. This occurred when there were too many enemy aircraft for radar sets to pick out a single plane for engagement.

GOR V was an emergency room at the bottom on the station platform. It never had to be used. In the passage down to it, the controllers and their assistants had to sleep with the lights continually on, in a strong draught and with GPO engineers passing up and down to look after the enormous switchboards, which were also on the old platform. The inn in Brompton Road between the station and the Oratory (*The Gladstone*) was generally known as GOR VI. When on duty it was the furthest one could go for "refreshment."

GUN OPERATIONS ROOM No. 2



Drawn by Tim Robinson



The dais in GOR I overlooking the plotting tables. Note the Lamson pneumatic message tubes and the coloured RAF 'Sector' clock which showed how up to date the information on the table was.

GCI radar

The Brompton Road operations room took part in an interesting experiment carried out with the Army. A specialised kind of radar, known as ground controlled interception or GCI, situated on the ground scanned the entire dome of the sky overhead to produce a live map of the sky. On this map were plotted all aircraft, hostile or friendly, flying within a radius of many miles. The display tube was known as a plan position indicator (PPI) in which a rotating beam swept the face of the cathode ray tube rather like the second hand of a watch but far more rapidly, producing the display now familiar at air traffic control (ATC) centres. Back then, it was entirely new and one of the first installations was the Army's anti-aircraft gun installation in Hyde Park during July 1941.

As a further novelty, a remote display and control were provided in the operations room in the tube station, about a mile away. A special linking cable was provided, using BBC equipment, and it was said that the display at Brompton Road was "the equal of Hyde Park's".

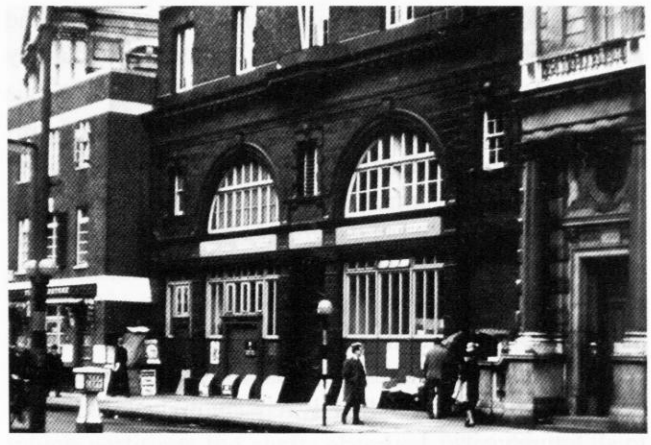
Maurice V Wilkes recalled the project in his book, *Memoirs of a Computer Pioneer*, which notes that, "The remote display was to be located in the operations room of the 1st A.A. Division, which was underground in a disused tube station in Brompton Road. Someone suggested that it would be worthwhile consulting H. L. Kirke, the chief engineer of the BBC, with regard to the transmission problems involved. 405-line television was operating in London as early as 1936 and was only closed down on the outbreak of war. The BBC had, therefore, much experience of the transmission of video signals. I went to see Kirke in his office and very much enjoyed meeting him."

Edward Pawley fills in some technical details in his book *BBC Engineering 1922-1972*, stating that, "among the miscellaneous projects on which the BBC gave advice was the setting-up of a video circuit over a cable pair, using the equipment that had been developed by the BBC before the war, to operate a plan position indicator for gunnery control."

Postwar operations

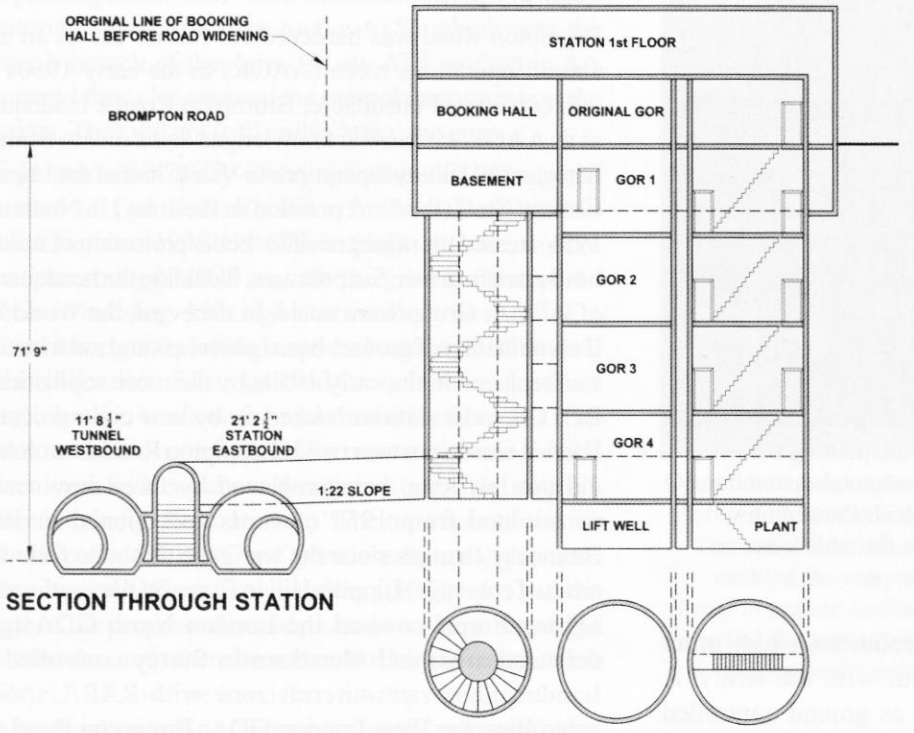
Brompton Road was hardened for further use as an anti-aircraft operations room (AAOR) in the early 1950s but was considered unsuitable. Brompton Road's inadequacy as an AAOR was now acknowledged and a memo from the Director of Military Operations to Vice-Chief of the Imperial General Staff (the No 2 position in the army) in November 1951 stressed the urgent need for better protection of military headquarters in war. Six premises, including the headquarters of 1st A.A. Group were noted. In the event, the World War II combination of ground-based observers and radar stations was replaced in the early 1950s by the more sophisticated ROTOR radar stations backed up by new control centres. For this reason postwar use of Brompton Road as an AAOR did not last long, being replaced by three new centres constructed from 1951 onwards and opened in 1953. Boundary changes since the war gave these the following areas of coverage: Lippitts Hill in Essex on the south side of Epping Forest covered the London North GDA (gun-defended area) and Merstham in Surrey controlled the London South anti-aircraft zone with RAF Uxbridge controlling the West London GDA. Brompton Road was retained as a backup AAOR.

With the demise of AA Command in 1956, the three new control centres were themselves redundant when guided missiles replaced gun defence. Other uses were found for Brompton Road and at one time it formed offices for the London District. The streetlevel building was later taken over by the Territorial Army. The building was largely intact and unaltered through the 1960s with some original tiling and signage remaining in the old booking hall. In 1971 there was a proposal to widen Brompton Road. The *Gladstone* pub on the corner of Cottage Place was demolished that year and in March 1972 the station frontage on Brompton Road was also demolished although the staff entrance on Cottage Place was left untouched and can still be seen today.



Brompton Road Station Entrance c. 1968. Photo by J E Connor.

An interesting 'might-have-been' occurred in 1987, when the site was earmarked for a new £1 million bunker. On 22 May, the *London Daily News* reported that the London Fire and Civil Defence Authority had decided to house its control room in the station. The bunker, intended to accommodate



SECTION THROUGH STATION

PLANS THROUGH STAIR WELLS / ROOMS

Drawn by Tim Robinson

60 civil defence staff, would act as an emergency co-ordination centre for west London following nuclear attack. It was to be one of four bases and was to be ready for occupation within two years. Later, on 19 October, the *Daily Telegraph* expanded this story, affirming: "The closed Brompton Road Underground station is being converted into a nuclear fallout shelter for local borough councillors to control north-west London in World War III. The station formerly housed the London anti-aircraft control centre; now 60 officials will be self-sufficient in a 70' deep bunker for 30 days"." In the event nothing was built.

The station was once again in the news in 1995 when someone attending an Air Squadron function plunged to his death down one of the lift shafts. This wasn't the first death at the station as on 27 March 1924, a man committed suicide by shooting himself through the head in one of the toilets.

Today the altered street-level building and attached drill hall is still owned by the Ministry of Defence and is maintained by the Territorial Army and used as the Town Headquarters (THQ) University of London Air Squadron and the University of London Royal Naval Unit. Occasional conducted tours of the station have been allowed in the past and in 2000 the children's television programme *Blue Peter* was allowed to film at the station including the gun operations rooms but new health and safety regulations have put a stop to all future visits.

What is left underground?

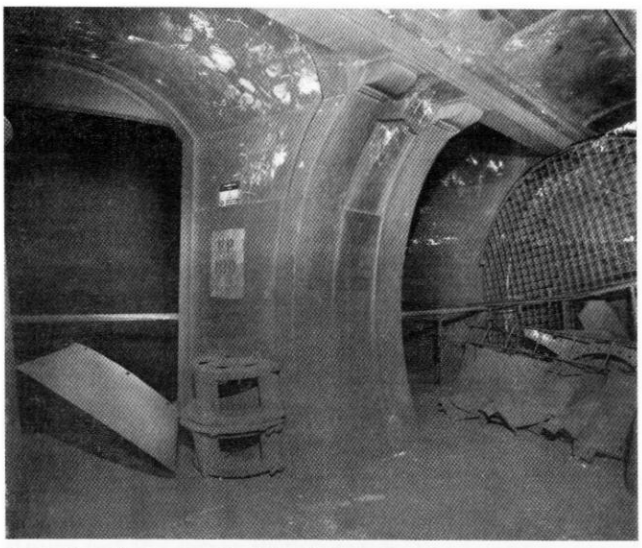
In theory, Brompton Road could be used for de-training in the event of an emergency evacuation as there is access from the track out through the former staff entrance in Cottage Place, but much of the station including the GOR's lift shafts and spiral staircase remains in MOD hands and even LUL staff are not allowed beyond the top of the stairs leading up from the platforms apart from a monthly inspection of the entire station.

The station is still well ventilated as one of the lift shafts is open to the surface but there is no emergency lighting and subways between the stairs and the ventilation shaft are extremely dirty with everything covered in dust, mainly from train brake linings.

It is possible to get a glimpse of the station from a passing train as the brick walls built alongside the track to create rooms where the platforms once stood are still there. In the centre of the station there is an opening in the brick wall opposite one of the five interconnecting passages between the platforms and a short section of platform remains although it's unclear if this is original or is a later addition to allow maintenance staff to alight from a passing train. Rail access was maintained after the station was converted but this is described as being at one end of the platform. There are two small rooms entered from this cross passage and one was a switch room where there is still a floor standing cabinet for controlling the air conditioning and filtration plant.

A short flight of steps leads up from the cross passage to a bridge across the eastbound track and on to the lower lift landing used by incoming passengers. The two entrances to the first lift shaft were bricked up when that shaft was converted into the Gun Operations Rooms but the two entrances to the second shaft remain. This shaft is open to

Much of the platform tiling is still in place with a number of embellished signs fired into the tiles at the cross passages. Photo by Nick Catford

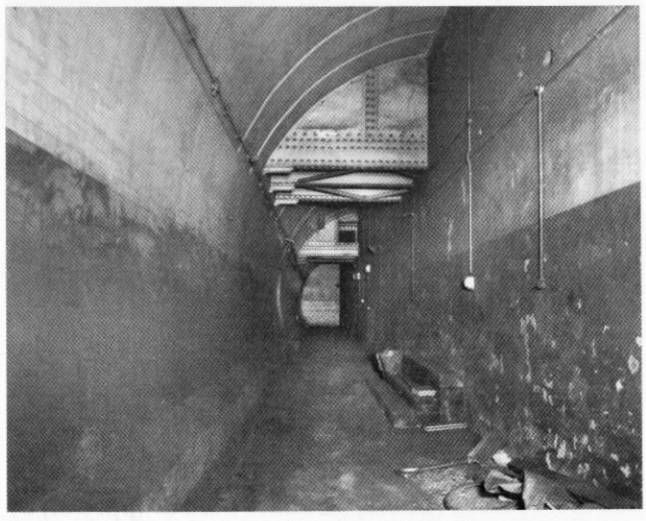


Only the platform exit side of the lower lift landing was used during WW2, the side seen here being restricted to ventilation only. The brick wall that now divides the shaft vertically can be seen in the left hand entrance. Photo by Nick Catford

the surface and traffic noise can be clearly heard. There is a 7 foot drop down into the lift well and a vertical brick wall has been built across the shaft up to the top so only half of the lift shaft is now used for ventilation. A dismantled fan sits on the lift landing; presumably this was once installed here to aid ventilation.

Back at the cross passage, there are short flights of steps down into the rooms created when the platforms were removed. A number of partition walls survive within these long narrow rooms and much of the original white and cream tiling is still in place although some of it was painted a matt grey during the war and the remaining unpainted tiling is now very grubby. The station name can still be seen in a number of places painted in large brown letters as can the decorated 'Way Out' and 'No Exit' signs fired into the tiles on either side of many of the cross passages.

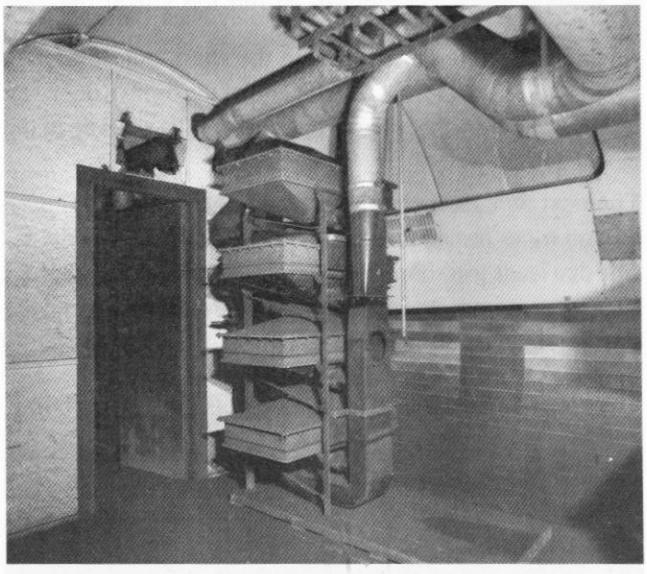
At the west end of the westbound platform a projection screen has been painted onto the end wall with a 'no smoking' sign



The site of the eastbound platform. Note how narrow the room is and the bottom of the two bridges leading over the station to the lifts. Photo by Nick Catford

below it. This room was used for screening information films for staff. The eastbound platform area was used as the teleprinter and communications centre and the westbound platform area was used as a rest area, this room would also have housed GOR V; in the event of an emergency. The two bridges taking passengers to and from the lifts can clearly be seen crossing the eastbound platform and track.

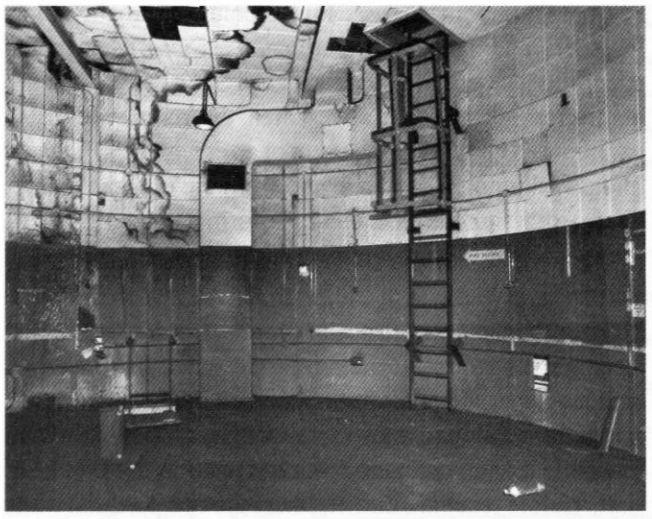
At the west end of the station, the last cross passage has another stairway up to the other side of the lifts on the lower lift landing; this was originally the way out for passengers leaving the station. At the top of the stairs, there are two wooden doors and once through these the subway turns left across the eastbound track to a locked metal grille. Beyond this grille is MOD property which is out of bounds to LUL staff. Before reaching the lifts, there are two partition walls dividing the subway into three rooms. Once through the second partition the original emergency spiral staircase is to



Air filters on the lower lifting landing. Photo by Nick Catford

the right and beyond that the GOR lift shaft. One lift entrance has been retained for access into GOR 4 while the original entrance into the second lift has been infilled forming a shallow alcove containing a rack of electrical switchgear.

Before the second (ventilation) lift shaft there is a further partition wall creating a filter room. Outside the room there is a mounted rack of gas filters manufactured by Sutcliffe and Sweetman. A further two racks of gas filters are to be found inside the room together with the controls for the air conditioning plant which is located in the adjacent lift well. There is a flight of steps down into the well where there is a large fan feeding ventilation trunking running through the bunker. The plant is on the opposite side of the brick wall which partitions the shaft, observed from the opposite landing. It turns out the partition in this shaft is actually two walls enclosing a staircase which zig zags across the shaft through four semi-circular rooms that have been built within it. The lowest room is entered at the top of the first stairway. There is a brick plinth along one side which might have been some kind of equipment mounting and vertical trunking



GOR II; the ladder was for emergency escape up to GOR 1 while the trap door on the left leads down to GOR III. Note the classic green and cream paint scheme and the use of acoustic tiles. Photo by Nick Catford

(intake and exhaust) running up the shaft, but other than that the room is empty. At the far end of the room a doorway leads to the stairs that double back across the shaft up to the next level.

The next two semi-circular rooms are completely empty; the top room has another brick plinth and a door at the far side that leads to a short passage. This leads into the adjacent 'Gun Operations Room' lift shaft and into the first of the circular gun operations rooms, GOR I. Apart from ventilation trunking and some electrical fittings the room is empty. There is a trapdoor in the floor close to the side of the shaft with a ladder down to GOR II below. A doorway leads out to the top of the spiral staircase in an adjacent shaft. We are now in the basement of the street-level building. A separate

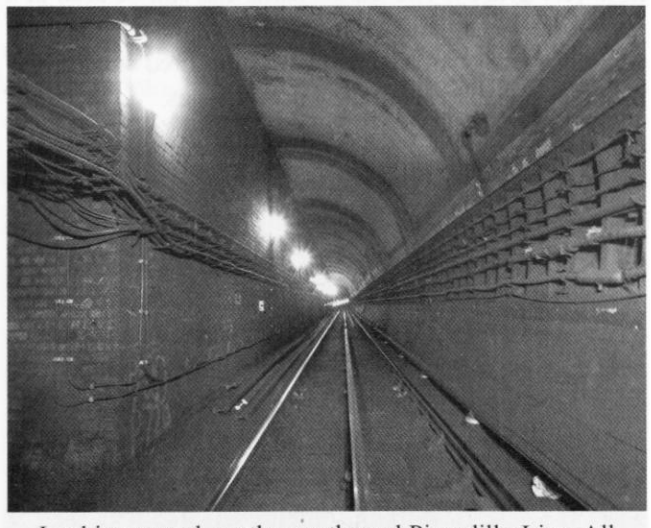
The cantilevered walkway from the spiral staircase leads into GOR III. Note the original wall tiling still in place. The spiral staircase continues to the lower lift landing from where there is access into GOR IV. Photo by Nick Catford

stairway leads up to the booking office where a door prevents any further progress as this is now inside the TA Centre.

The spiral staircase is still in good condition with much of the original white, brown and green tiling still intact. A short distance down there is a doorway into GOR II with a wooden board with '2' painted on it hanging on a guard rail just outside the room. Again the room is completely stripped apart from electrical fittings and a vertical ladder up through the trapdoor above, a sign on the wall indicates this is the fire escape. A further trap door gives access to another ladder down into GOR III.

Further down the spiral staircase is the entrance to GOR III; because of its position in the shaft in relation to the stairs a short cantilevered walkway has been constructed to give access to this room. Once again the room is empty apart from ventilation trunking and electrical fittings. There is no trap door in the floor down to GOR IV below. GOR IV is at the base of the lift shaft and entered from the lower lift landing. In this room, which controlled the south London guns, there is a large 1" to 1 mile faded Ordnance Survey map on the wall overprinted with a Cassini military grid and overdrawn with gun site locations. There is a glass window into an adjacent room. Unlike the far side of the lift landing which is very dirty there is no easy route for the dust from the tube operations to reach this area which remains relatively clean and dust-free.

Pencil marks on a London Transport plan reproduced in *London's Disused Underground Stations* indicate that a separate exit from the bunker was constructed to Brompton Square, to the northeast, and a user of the building confirms that a pedestrian tunnel ran from the lift well to a rotting wooden staircase up to ground level. The surface exit appears to be a squat brick structure with a concrete cap and small door next to an electricity kiosk inside the railings of Brompton Square, facing Brompton Road. No evidence of this exit route was found underground.



Looking east along the westbound Piccadilly Line. All passengers see is the brick wall at the former platform edge. The entrance to the former platform area is now halfway along the left-hand wall. Photo by Nick Catford

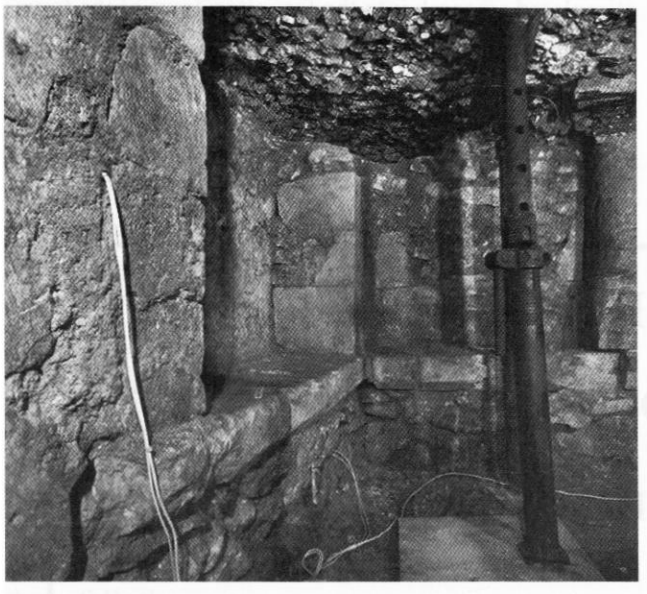
It should be stressed that this site visit was made in 1996 and more recent visitors, who have been dropped off by a passing train, have not been allowed in to the GORs. All visits have now been stopped on health and safety grounds.

Possible Medieval Synagogue

Information from Guildford Museum

In March 1997 members of Subterranea Britannica visited the site of a possible medieval underground Synagogue that had been discovered in 1995 by archaeologists from Guildford Museum beneath a High Street shop.

The chamber was discovered during alterations to the shop. The back part of the shop was at a higher level than the front and the architect thought there might be archaeological remains below the higher level and asked the Museum to investigate. This had to be done from the side rather than from the top in order that the shop could remain open. A hole was opened in the rear cellar wall and the chamber was found behind the wall. In the event, it was not the cause of the higher level, which started beyond the hidden chamber. The rise in levels was caused by the slope of the hill.



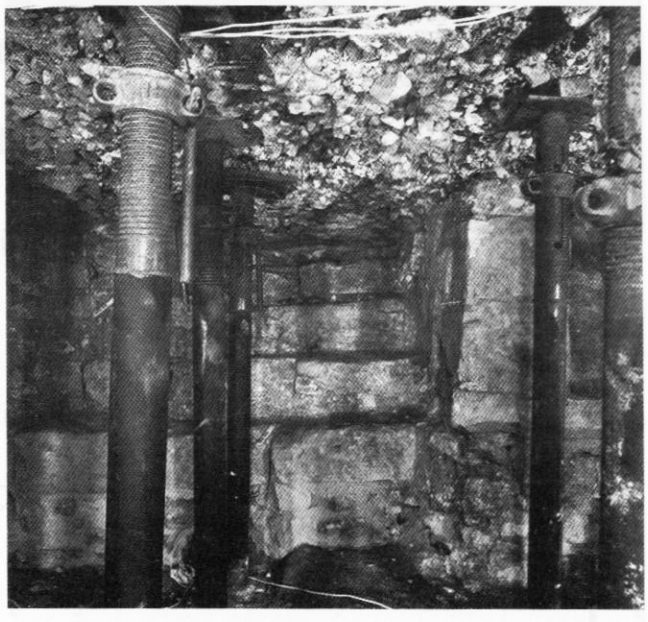
The north and east walls. The entrance to the chamber from the building it was attached to is beyond the left side of the photo. To the right is the east wall, with the bench and the column of the blind arcading. Photo by Nick Catford

The building is the bottom part of a small room about ten feet square. The door is at the northwest corner. A stone bench runs all the way round the room and there was another doorway at the southeast corner with steps leading up. These steps were blocked up during the life-time of the room. The room was built in the late 12th century and demolished in the late 13th century. The walls were painted with red, black and indigo – a very expensive colour in those days.

The room was built at the back of a house and was part of the house – it was not added on later. There is nothing left of the house but it may have had an undercroft, because a Victorian photograph shows a low door which looks like the entrance to an undercroft. The whole house may have been built of stone – not the local chalk. This would mean that it belonged to a wealthy man.

Very few 12th-century houses survive and there is nothing like this room so it is difficult to say what it was for. It looks as if it were built so that people could sit around the walls, perhaps for a meeting and this is why a synagogue was suggested. Medieval Jews were wealthy business men and could have afforded a stone house with painted walls and its own synagogue. They also needed stone houses as protection from theft and religious persecution.

There is nothing to prove that it was a synagogue, but it fits in with what is known about medieval synagogues from documents. It was at the back of the building and was partly underground. Synagogues were meant to be tall, but it was better to build part of it underground so it was tall inside but not so obvious from the outside. It was demolished around the time that the Jews were expelled from England in 1290 and it seems to have been in good condition when it was demolished. The upper walls were knocked down and thrown into the part below ground, which was covered over and hidden until 1995. This is odd, since the late 13th century was a time when Guildford was expanding and people needed more space in the fairly small town.



The south wall, with the steps which probably went out to the backyard of the property. Their medieval blocking has been partly removed by the archaeologists. Photo by Nick Catford

There are some odd features about the chamber. The east and west walls were deliberately built sloping uphill and the base of the each column is of a different style. Other blocks of stone also suggest that the stone came from another building. The columns of the blind arcading are U-sectioned and form part of the wall behind, which is very unusual. Normally the columns are cylindrical and separate from the wall. It is interesting that the only other

local examples known are in the Chapel of the Keep of Guildford Castle, which is mid-12th century.

So, could the chamber have some link with the castle? This is possible and does not rule out the Jewish connection. Possibly a wealthy local bought left-over stone from the castle. The chamber could have belonged, for example, to the Earl of Surrey or another nobleman from the south who wanted a house near the Royal Castle, or it might have belonged to a Bishop or Abbot, for the same reason and also because Guildford was a day's ride from London. There are no documents to confirm this one way or the other. The chamber is the wrong shape for a chapel.

The only object found in the building was a coin of Henry III (1216 – 1272) which was in a crack in the stone bench. It was of a type minted between 1272 and taken out of circulation in 1279. There were pottery sherds in the demolition rubble which show that the room was knocked down in the late 13th century.

There were Jews living in Guildford before the expulsion of 1290, though there are no records for the 12th century. Guildford was not one of the official towns where they were supposed to live, but they did live in other places. One Guildford Jew was Isaac of Southwark who also had property in London and Winchester. His house in Guildford was broken into in 1274, by a man called Thomas who may have owed money to Isaac. Isaac had a wife, Thippe and a daughter Slema. Other Jews were mentioned in the mass arrests of the 1270s: Abraham, Floria, Josce and his wife Formosa. Another Jew, Bonefey, was mentioned in 1295 as having once owned property in Guildford.

Guildford's Jewish population may have been too small to regularly provide the minimum of ten males needed for the full rituals, but a synagogue of this date would have been a private one anyway, and could have been used for prayer and study as well.

We may never know what the chamber was used for, but it has provided information about medieval Guildford and stimulated research into the forgotten Jews of the town.

The chamber been stabilised and conserved and is still accessible.

Sub Brit Autumn Day Conference

Saturday 11 October 2008

Bucks University High Wycombe

Programme includes:-

Clifton Rocks Railway - Bristol
Old Chalk mines and their stabilisation
Canal Tunnels
** Military Radar in WW2 and the Cold war
** Titan Cave
Members' Contributions

Book this date in your Diary NOW

More details and booking form will follow

** not yet confirmed

Brian Hillman : bsh@lineone.net
Day Conference Organiser

The 2008 Mainland Europe Study Weekend, Paris

Friday 30 May – Monday 2 June 2008

Paul W. Sowan

Your reporter first visited Paris as a schoolboy in 1956, arriving with schoolmates and teachers by train at Gare St. Lazare, the party having taken the Newhaven – Dieppe ferry. Were we wearing caps and blazers? Quite possibly I suppose! The Metro (especially the rolling-stock) has changed and been extended since then. The Catacombes are much as I remember them 52 years ago. It is always a pleasure to return to the city and, each time, to see more underground sites. The 2008 SB Mainland Europe Study Weekend, and the second to be based in Paris (we were there in 2004), did not disappoint.

We travelled from St. Pancras International by Eurostar, departing at 14.05 and reaching Gare du Nord in just over two hours 20 minutes. After checking-in at an Ibis hotel a few minutes walk from the station, most relaxed at a nearby café-cum-bar, before and after dinner at the hotel. We numbered 39 from the UK, Joep Orbons and his son Jeffrey from Maastricht joining us for the weekend to make a total of 41. Our ages ranged through seven decades.

Saturday morning, 31 May: Archaeological Crypt / Catacombes

We all had, helpfully, 'go-anywhere' tickets valid for three days on the Metro, RER, buses, trams (there are a few still) and Paris area SNCF trains.

The party divided. Those, by and large (and including your reporter), already familiar with the Catacombes formed Group A and visited the Archaeological Crypt at the west front of Notre Dame on Île de la Cité. Group B visited the Catacombes at 1 Place Denfert-Rochereau on the Left Bank.

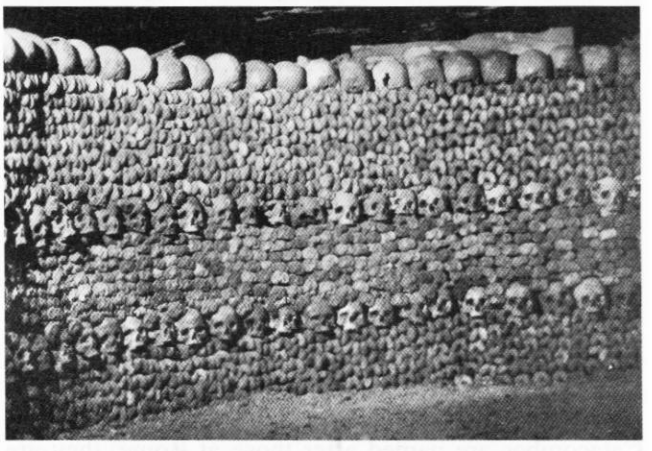
(a) Notre Dame Archaeological Crypt

This is a most impressive archaeological site, preserved *in situ*, now roofed-over in the large open space fronting Notre Dame Cathedral. The massive stones of Roman (BC 52 onwards) and mediaeval foundations survive sufficiently to render it easy to visualise the former waterfront, and the ancient street layout. They include such recognisable features as cellars, cellar-steps and stone arches, a hypocaust, a sewer, and a well. All the stonework is clearly related to the former narrow street plan. The faint but unmistakable smell of drains down here seemed somehow appropriate. No doubt the street in ancient times offered an interesting blend of natural odours.

Around the walls are superbly executed displays of artefacts, equally superbly provided with explanatory texts, and a series of maps and models conveying a most helpful introduction to the geomorphology and topography of the city from Roman times onwards including (of interest to Subterranea Britannica members in particular) the distribution of open-cast and underground stone quarries, gypsum mines, lime kilns, and the like.

It is a striking contrast to the 'minimalist' approach taken at the fragment of a Roman amphitheatre, likewise preserved *in situ*, in a basement at London's Guildhall. Of course, at home, similarly excellent displays are to be seen in the Museum of London. However, it all seems so much more real on the Île de la Cité where, at the very heart of the city, one can stand beside the old stones and get a feel for the layout and growth of the place, the shifting course of the Seine, and the hills on the left and right banks. There is an impressively well-stocked bookstall.

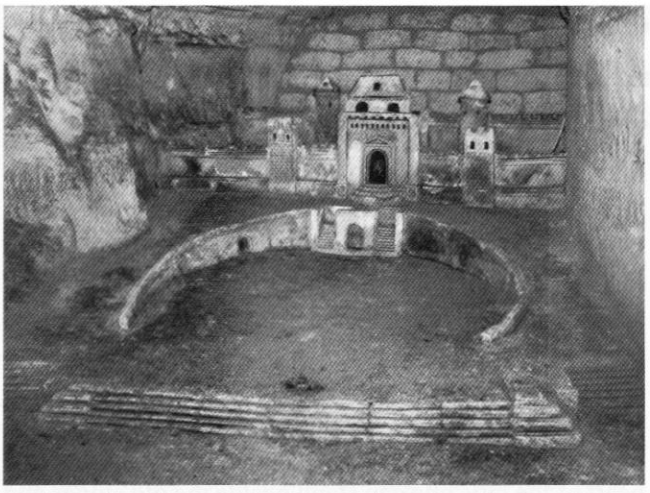
(b) Catacombes



Wall composed of femurs and skulls in the Catacombes. Photo by Joep Orbons

Paris, unlike London, has a good store of useful minerals beneath its streets. Good building-stone (a Tertiary limestone) could be quarried, often underground, close to the centre. In contrast, stone for London had to come from much further afield, from quarries in Kent, Surrey, Dorset, and even France.

As Paris expanded, new houses surrounded extensive graveyards that had formerly been outside the built up area. Numbers of these cemeteries were cleared to make way for building and to combat the risk of disease through contamination of water supplies. The bones of six million or so former Parisians were deposited from 1786 onwards in some of the abandoned subterranean quarries. The gigantic ossuary (occupying a mere one seven-hundredth of the superficial area of the Parisian subterranean quarries), about 20m below street level at Place Denfert-Rochereau, has long been a tourist attraction. One wanders about 1.7 km through galleries whose sides are walls of thigh-bones neatly arranged endways on, with rows of skulls by way of decoration. Behind this tidiness,



Sculpture by Décure in the Catacombes. Photo by Joep Orbons

the smaller bones have just been thrown in, in utter confusion. What a business the resurrection and re-assembly of all these bodies will be!

The whole place hardly looks like a stone quarry, as the stone has been carved and decorated to make the scene suitably funereal. The access and exit passages are testament to the consolidation work carried out by the 'Inspection Générale des Carrières', set up in 1777 to ensure the ancient quarries did not compromise the stability of buildings above. Each and every consolidation is dated in exquisite carving. At one point, you visit a small area of untouched quarry. The route passes below the RER Sceaux line and the Arcueil aqueduct. Near to the exit are examples of the 'Fontis' (collapses) that show why inspection and consolidation continue to the present day.

As Martin Dixon's tour notes point out, although the Paris Catacombes are named after those at Rome, they are different as they are a secondary use of a former quarry not a primary place of interment.

By some miracle of timing, both parties found themselves, after these visits, on the same Metro train bound for Jourdain station and lunch at *Le Mediterranéan*, which restaurant we completely filled, to enjoy couscous and stewed vegetables (and assorted pieces of meat for those who eat that sort of thing)! Here we met Julian Pepinster, who entertainingly explained how these dishes should be consumed.

Saturday afternoon, 31 May: aqueducts in NE Paris

We were now in the district of Belleville, in the hills of northeastern Paris and the 19th arrondissement, a predominantly working-class area well off the well-trodden tourist trail (but decidedly **not** well-off!). This area was, until about 1865, 'waste ground, patched here and there with hovels, and pitted with gypsum quarries.' The gypsum, of course, being a soluble evaporite deposit, was mined, and used for making plaster-of-Paris. Here members of the Association Sources du Nord – Etude et Preservation (ASNEP) explained the historic water-supply arrangements for Right-bank Paris, and showed us inside several of the surviving 'Regards' (inspection buildings in which one can 'regard' the water) where springs from aquifers on two levels in the hill are tapped and whence aqueduct tunnels convey water to the city.

Junction in 12th-century Belleville aqueduct. Association Source du Nord - Etude et Préservation

Near the Place des Fêtes Metro station we visited the Regard de la Lanterne, an inspection and access point at the head of the Belleville aqueduct system. The domed circular stone ashlar building dating from 1613 is the French equivalent of a Scheduled Ancient Monument, and somewhat resembles a large ice-house in shape and size, but has a double flight of stone steps leading down inside from which the main aqueduct can be entered, although we did not go very far, as we were due to traverse a more commodious such tunnel later on. Three small feeders join in this Regard, from whence a little trickled towards the city. Until the 1970s, when the neighbourhood was redeveloped with unappealing modern blocks of flats, this venerable structure stood hidden from public view in private backyards. It now stands in a small children's playground (Jardin de la Regard de la Lanterne.) The present structure replaced an earlier one, the system itself dating back to the 12th-century.

A short walk then took us to a wide manhole cover occupying much of the width of a narrow pavement in a nearby street of small shops. This was duly lifted, attracting some interest from the proprietor of the shop outside which it is situated. Most of the party then climbed down a short vertical iron ladder into a commodious stone-lined tunnel, the upper end of which has been blocked by modern foundations. Persons were posted at the entrance to guard against the precipitation of passing shoppers into the underworld. We then walked some 400 metres gently downhill below the backyards of the said shops, and clambered out of another manhole further down the hill. The floor of this tunnel was quite level, and had a shallow central channel about 20cm wide and four cm deep cut into the stone: it seemed to be designed to accommodate a paltry trickle within a flagstone roofed tunnel about a metre wide and two metres high. Our visit almost certainly represented the largest number of people

to occupy the tunnel in its 900-year-old history! The exit manhole was conveniently located outside a small bar whose products we sampled.

Exiting the Belleville aqueduct in front of a convenient bar. Photo by Joep Orbons

These Parisian aqueduct tunnels were interesting to compare with others (visited at various times by Subterranea Britannica) in Britain. Those (publicly accessible) below some of the streets in central Exeter seemed most similar, being of cut-and-cover construction, but significantly narrower and with higher stone-slab ceilings. They had been equipped with lead pipes, whereas at Belleville it seems water simply ran in a shallow channel cut into the stone floor. Those at Bristol, still in water, are true rock-cut tunnels in the Carboniferous limestone. We then visited several more small stone Regards housing springs tapped for the city's water supply. Of originally 40 such buildings, we were told, 19 survive: we saw the best five.

Saturday afternoon, 31 May: la Petite Ceinture railway and tunnel

At the lower end of the Rue de la Mare we were able to access the disused Petite Ceinture railway, at a point where there is open track between two of the longer (over 1 km each) single-bore double-track tunnels. This 'inner circle' line was made by the Chemin de Fer de Ceinture between 1852 and 1869, paid for by the five mainline railways and linking their several termini. It has since been superseded by the Grande Ceinture, an 'outer circle' line, dating from 1875. Much of the traffic was accounted for by military requirements (men and equipment), diversion and 'special' passenger trains, freight trains, and rolling-stock transfers.

We walked northwards through one of the tunnels, which is quite straight. Contrasting with the surprisingly tidy stretch of open track, we found in the tunnel quantities of rubbish including the remains of railway cables and equipment, and general refuse. Apart from refuges in the walls, no features (such as shafts) of special interest were noted although the double track surprisingly remains in situ throughout. At the far end we emerged in the Parc des Buttes Chaumont.

Saturday afternoon, 31 May: Parc des Buttes Chaumont

Disused gypsum mine with man-made waterfall in Parc des Buttes Chaumont. Photo by Joep Orbons

On emerging from the Petite Ceinture we climbed up into the Parc des Buttes Chaumont, created in 1866 – 67 by landscaping an area of former gypsum mining and opencast digging for clay and sand which had been used as a location for slaughterhouses and rubbish tips. One author has described it as formerly 'the rubbish dump of Paris' but, now, 'the most picturesque of the Paris parks.' This very attractive 60-acre site (much used the afternoon we were there by wedding parties and their attendant photographers) features an artificial lake, and a grotto, formed from entrance and outer chamber of a former (but now filled) gypsum mine. It also contains an equally artificial, but very photogenic, semi-subterranean waterfall. Water is taken from the Canal St. Martin (to the west), which Subterranea Britannica visited in 2004.

We took over an entire small restaurant near the hotel for Saturday night's dinner, memorable for the writer for the mountainous plateful of crudités he was served as a vegetarian version of the starter course. So huge was this most agreeable offering that he never did reach whatever might have been intended as a main course!

Sunday morning, 1 June: the Paris Metro

This morning was devoted to another Julian Pepinster 'Metro mystery tour,' as in 2004 but visiting, with perhaps

one exception, new sites. Much of the Metro was made by 'cut-and-cover' construction, as with London's Metropolitan, District, and Circle lines, and significant parts are above ground and even on viaduct. Some lines cross over or under the Seine.

All 14 Metro lines are interlinked by connecting curves, so empty trains can be routed from line to line according to operational requirements. At the terminus (and occasionally the bypassed terminus) of several lines trains run empty around a loop line in tunnel, stopping again at the up platform of the same station to pick up passengers going back into town. Where line extensions have bypassed some of these terminal loops, the tunnel loop has either been abandoned or used for other purposes. And Paris, like London, has a number of disused stations, the deserted platforms of which can be seen by passengers in trains in service.

The Metro lines are supplemented by those (lettered A to E) of the Réseau Express Régional (RER), which accommodate main-line loading gauge rolling-stock (at least some of it forming double-deck trains). These lines have more widely spaced stations, and run further into or beyond the city suburbs than the Metro.

Line 7 bis

We started the day's tour at Louis Blanc on line 7, where the station platforms are unusually underneath two separate surface roads. We took the cross platform interchange to line 7 bis (bis meaning 'again' or 'repeat') This line was once a branch off the main line 7 but now operates standalone with a cross-platform interchange with line 7. 7 bis itself has a one-way loop at the easterly end. The rolling stock on the line is unique, being composed of three car sets with steerable single axles rather than bogies. The leading axle is non-load-bearing and transmits steering commands to the rest of the train. The idea was to save weight but the ride is not smooth and the maintenance costs are high so the experiment is not being extended.

Place des Fêtes

On arriving at Place des Fêtes we were at one of the deepest stations on the Metro. The longest escalators on the system convey passengers 22.45m to street level. (Lifts at the nearby Buttes-Chaumont station ascend 28.7m) Parts of the line hereabouts had to be driven through an area of old gypsum mines, which complicated construction. We were able to go behind the scenes and view the disused lift shaft and stairs. Because of its depth, Place des Fêtes was one of the very few Metro stations to have 'official' civilian air raid shelters in the Second World War and we were able to see the site of gas-tight doors and ventilation equipment.

St. Martin

We next visited the disused St. Martin station which some of us had previously seen in 2004. It opened in 1933 but, after just 6 years, closed along with scores of others at the outbreak of war. It is an unusual example of a disused station on two separate lines (8 and 9). The lines are stacked above each other leading to low-roofed platforms on line 9 as they are directly below line 8. After the war the station was used as a showcase to try and rekindle advertising income and as such is home to a number of striking advertising panels. Sadly many of these have been obliterated by graffiti. The decision to finally close (or more precisely, not to reopen) St Martin was taken as late as 1967 until which time it still appeared on Metro maps.

Under-Seine tunnels of 1910

We inspected stations at Châtelet (on the Right Bank), Cité (on the island) and St. Michel (on the Left Bank) on line 4, the first to pass under the Seine in tunnel in 1910. The ground was extremely waterlogged and the river crossings, station tunnels and access shafts were all prefabricated in steel and lowered into position before being pumped dry. This revolutionary method of tunnel construction paved the way for many others. Before 1910 this line was operated in two parts, north and south of the river, which opened in 1908.

A ride on a Sprague train

Sub Brit travelling on the historic Sprague Metro set.
Photo by Joep Orbons

It was then, from St. Michel, that we followed Julian's verbal instructions, 'Line 4 direction Porte de Orléans, one stop to Odéon, changing there to line 10 direction Boulogne-Pont de St. Cloud, then eleven stops to Michel-Ange Auteuil, where we change to Line 9 - 5 stops to Trocadero, then direction Charles de Gaulle-Etoile (at the end of Line 6) and finally Line 2 direction Nation, three stops (I think!) to Monceau'. Mysteriously, but we found out why, it was most important that we should all be at Odéon in good time. Having hurried there, we let the first train through, and were recommended to board the second to last carriage on the next train. This turned out to be a vintage 'Sprague' set (the sort I rode on in 1956) which is run occasionally on Summer Sundays. Confusingly, Julian and some others got off at the next

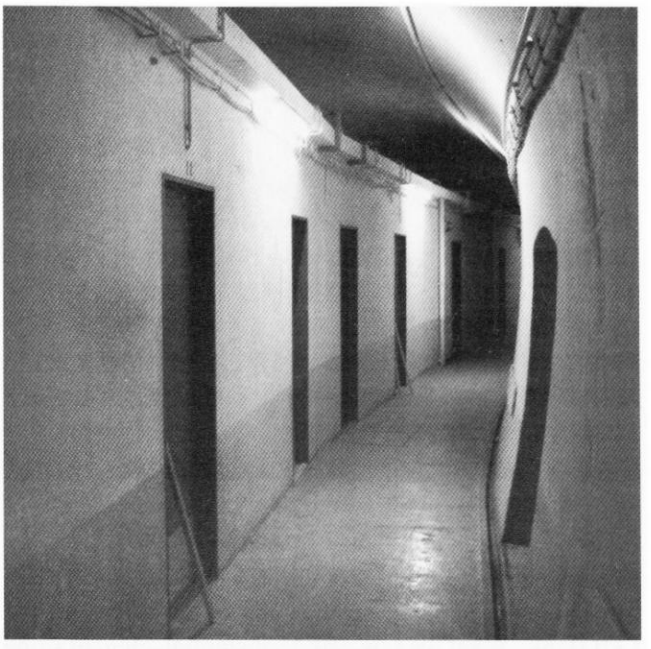
stop, and hared up the platform to board the next carriage on the same train. This turned out to be in order to travel on the more comfy upholstered seats in the 1st Class carriage that was still a feature of the set. This, astonishingly, was the only occasion this weekend when we temporarily lost a member of the group, Malcolm having attempted this Sprague carriage change at Mabillon but failing to reboard. Fortunately, he was able to find his way to the restaurant booked for lunch near Port d'Orléans.

World War II Installation at Monceau

Gas-tight running tunnel door at Monceau Metro Air Raid Shelter. Photo by Joep Orbons

Close to the Parc Monceau we traversed a very superior residential district, quite a contrast with the heights of Belleville, to descend a flight of steps to what might have been taken for a disused public lavatory but was in fact a suite of offices built inside one of the by-passed passing loops mentioned above, all quite empty but with fully operational lighting. This had been set up in the Second World War as the protected operations centre of the Metro, and as an air-raid shelter for its Directors. The site had been used as a training centre postwar but even now, completely disused, many interesting features remained. An original sump water pump – driven by compressed air – and ventilation equipment including filters were still in situ and operating.

On the city side of this loop, we found a stretch of disused tunnel (with conductor rail still in place which we were instructed to respect just in case it was still 'live', an operational possibility) forming a home to an assortment of prewar carriages all in need of repair or sprucing-up and removal of graffiti. Also down here was a set of tunnel-size air-tight doors that would have allowed a Directors' train to arrive and be stabled in safety. It was explained how the doors could seal the running tunnel, with accommodation for the rails; one of the doors being demonstrated in action. The tunnel doors could be by-passed via a pedestrian tunnel which of course was itself equipped with an airlock.

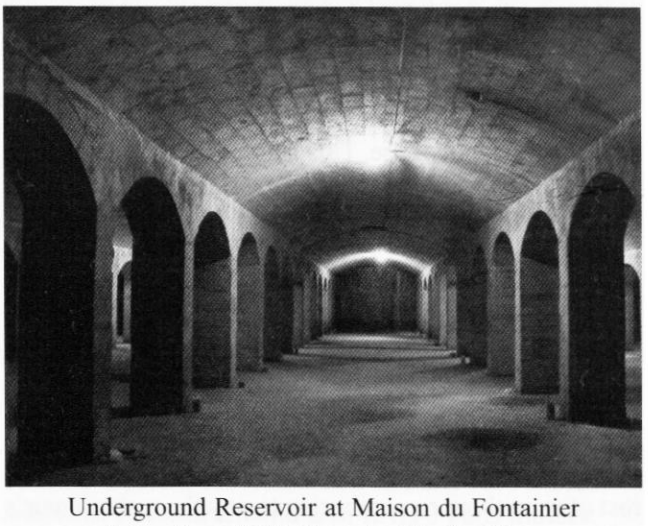


Disused 'Monceau' turning loop used as underground Metro Operations Centre during World War Two. Photo by Joep Orbons

A ride on a double-deck RER train

Then it was back on the Metro to Etoile, and a double-deck RER line A train to Châtelet and RER Line B to Port Royal and lunch. This was several members' first ride on a double-decker, although they are quite common in mainland Europe which has a more generous loading gauge than our own railways – the bridges and tunnels are higher and wider. Some of us reminisced about seeing Britain's only experimental double-deckers which ran for a short while on (I think) one of the London Bridge to Dartford lines. A great many run also around Berlin and Sydney.

Sunday afternoon, 1 June: Maison du Fontainier



Underground Reservoir at Maison du Fontainier dating from 1845. Photo by Martin Dixon

The Maison du Fontainier (otherwise the Grand Regard de l'Observatoire) stands next to the city's Left Bank Observatory, at the south end of the Avenue de Observatoire, behind a high wall. The premises, other than the underground parts, are currently in use as an

The Sub Brit group on the steps of the Maison du Fontainier. Photo by Martin Dixon

establishment for disabled children. This was a focal point for aqueducts tapping springs for water supply to the Left Bank. What we saw was a substantial, elegant stone building of two storeys erected above a basement in which and beside which in the adjoining land are aqueduct tunnels, stone tanks, and reservoirs. Effectively this was the 'distribution end' of a water supply very similar to the one we had seen at Belleville on the opposite bank.

Our local guide from Paris Historique here explained that the upper floors of the building were erected as a house for the superintendent of the water supply. The building and the aqueduct on which it stands date from 1613 – 1623. The aqueduct approximately follows the line of an older Roman one. In the basement we were able to see how water entered from an aqueduct tunnel, such as those seen the day before, and entered one of three stone storage tanks, 'one for the King's palaces, one for the City, and one for Jean Gobelin, the contractor.'

Unlike the Regard de la Lanterne, the basement proved to be a spacious and well-lit structure of fine ashlar masonry. Off to one side, under adjoining land, we were able to inspect the interior of a large, but empty, covered reservoir now out of use. This larger reservoir dates from 1845 when the storage capacity was increased to capture overnight flows. Members made their own way, at leisure, back to the hotel.

Dinner was at a restaurant next-door to the Gare de l'Est called *Extérieur Quai*, – "Outside Platform". Julian had brought with him (in a real Citroen 2cv) a box full of books on the Metro and underground Paris, and did good business on behalf of ADEMAS, his Metro Society. Such a pleasant evening was this that our leader left with the rest of us without remembering to pay the restaurateur's bill! A call to Martin's mobile telephone past midnight, as he was part-way across the concourse of the Gare de l'Est, conveyed a message to the effect that the owner of the establishment hoped we had all enjoyed our meal, and would like to point out that it is traditional in Paris to pay for dinner! Perhaps he saw our forgetfulness as a compliment in the enjoyability of the evening he had hosted.

Sunday night at the hotel was enlivened by a (false) fire alarm at 2.30 a.m. Some heard it, recognised it for what it was, and duly negotiated the fire escapes and assembled, more or less clad, on the street outside. Some heard but ignored the alarm. Some just slept through it. Curiously, perhaps worryingly, the hotel staff made no attempt at a roll-call. Neither then, nor the following morning, was any explanation or apology offered. We all got back to bed some time after three a.m.

Monday morning, 2 June

The plan this morning had been to visit the bunker below the Gare de l'Est, the mainline terminus serving trains for Strasbourg, the Rhine valley, Switzerland and beyond. This was constructed as a secure traffic control centre in the years leading up to World War II by the French. It was taken over by the Germans who added their own signage which in turn was patriotically painted out on the liberation of Paris! The bunker remained secret until the 1990s and is in an excellent state of preservation.

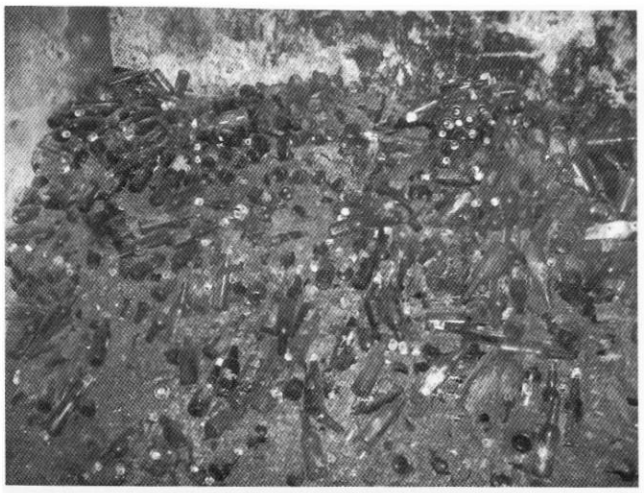
Sadly, this visit was not to be, as a result of building work at the station. An unexpected free morning in Paris is never unwelcome, and the group split up for separate activities. The largest contingent followed 'Official Plan B' and visited the Père Lachaise Cemetery. This immense site (109 acres) opened in 1804 and is the final resting place of hundreds of famous people, including Oscar Wilde, Edith Piaf, Jim Morrison and Marcel Proust. There is a large underground 3 level ossuary built in 1950 but this is 'off-limits' for visitors.

The party reconvened at the very modern Gare Montparnasse SNCF terminus in time to catch the 12.02 double-deck train to Sèvres, some 10 km south-west of the capital.

Monday afternoon, 2 June: Sèvres quarries / wine stores / brewery

The little town of Sèvres is best-known for its porcelain, and second-best-known as the location of the International Standard kilogram and metre. We saw nothing of those claims to fame, but disappeared (led by a member of the local archaeological and historical society) through an inconspicuous door in a very ordinary block of flats. What we found behind the door became more and more impressive as the tour progressed.

The flats had been built (on the site of a former brewery) up-against and over a crumbly limestone cliff face. So our first impression was of something like the space below the Broadmarsh Centre in Nottingham, where there is a series of rock-cut 'caves' used over the centuries as cellars and tanneries. Inside the cliff at Sèvres, however, there are very much more extensive former building-stone quarry tunnels which were adapted as the King's wine cellar (for Versailles) in the 18th-century. From 1852,



Bottles at abandoned Sèvres underground Brewery surrounded by their disintegrated cases. Photo by Martin Dixon

the site was operated by Meuse as a brewery and for beer storage, which use continued until 1990.

Here again, as in the Catacombes, the original underground quarrying landscape is largely hidden as a result of the secondary uses of the site. There is much inserted masonry, some in stone and some in brick, numerous stacks of empty bottles and the rotting remains of timber casks, and some truly enormous beer storage tanks. We were shown the marks on walls and floors where some immense wooden casks had stood, perhaps not as huge as those famous ones still to be seen under the castle at Heidelberg, but capable of holding sufficient drink for a party and a half to be sure.

And so to London

We took the 17.10 Eurostar back from Gare du Nord, stopping (a novelty) at Ebbsfleet (on the Dartford Marshes) on the way back, and arriving in two hours 24 minutes at St. Pancras, where your correspondent retired to the sometime Shire Bar (now the John Betjeman) for his first pint of real beer for three days!

Our thanks are due and tendered, especially, to our Parisian colleagues for showing us and explaining the sites, to Linda Bartlett and Martin Dixon for their as-ever meticulous planning, and to Richard Bonella and Stewart Wild for assistance with translation. We had enjoyed good company, interesting sites, excellent meals, fine weather, enthusiastic guides, and further samples of John Burgess' and Martin Dixon's apparently inexhaustible stock of jokes.

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Dartford Tunnel Transport

Keith Ward

As drivers join the endless queues trying to cross the Thames on the eastern side of London via the tunnel or the bridge they are usually not thinking about anything other than their frustrating routine experience.

So, let's look at some interesting aspects of the tunnel and the types of transport that have used it since it was opened to traffic in 1963.

The pilot tunnel was completed just prior to World War Two; unfortunately no photos seem to be available. It was a very small bore; however the GPO made good use of it to carry telephone cables. These formed part of an outer ring which was created to be able to divert phone traffic around London if any Exchanges were bombed or put out of action for any reason. The eastern section ran from Margaretting exchange on the A12 Cable to Keycol on the A2 Cable (the numbers are the roads which the cables followed); in the other direction the cable followed the A25 road - thus the ring was a sort of early cable M25! As far as I am aware, the cables remain in use through the old tunnel.

A recently released file from the National Archives gives details of the pilot tunnel for the first time. In 1951 it was accessed by shafts fitted with electric lifts that held six people. Surface access to these shafts was by an unmetalled road. It was originally planned to provide access to the tunnel using 1 in 28 slope passages but these were never built. The tunnel itself was 12 feet in diameter and lined with cast iron rings. There was no roadway, instead passage through was on wooden staging as the invert had between two and three feet of water in it.

Public transport through the Dartford tunnel has always been surprisingly poor; when introduced it is always poorly patronised and doesn't seem to last long. To encourage cyclists, two Thames trader buses were built for the tunnel opening. These were of unique design, having cycle racks on the lower deck and seats upstairs; they were loaded at special loading platforms. Unfortunately the cyclists never came and the service lasted just a couple of years.

The only public river crossing is the Gravesend-Tilbury ferry which still runs every 30-60mins; however in the 1960s it was more frequent - every 15-20mins. As a consequence, one would have thought a bus alternative would be popular, but no! The first bus was the LT 370, which ran from Grays to Dartford about every 2 hours and this was soon gone! This was followed by Eastern National who extended the journeys on its number 2 route from Grays to Southend through the tunnels at similar paltry frequencies. This too disappeared due to lack of passengers.

Bus number 402 from Southend to Dartford appeared in the early 1980s with four a day, but that also didn't last long, even after some journeys were extended to Victoria via south-east London. What looked like salvation were the massive shopping centres at Lakeside and Bluewater. The openings saw a spate of commercial routes springing up, such as the Romford to Lakeside

and Bluewater bus number 348 every 30mins. In the end, many of these were cut back and apart from some Saturday shoppers' routes, only an hourly Ensign bus number X80 now runs from Gravesend to Lakeside through the tunnel.

An interesting joint coach group was set up in 1962, called Dartford Tunnel Coachways. They established a series of express coach routes linking south coast resorts with East Anglia and the Midlands. It was jointly run by four national bus companies - East Kent, Maidstone District, Southdown and Eastern; and used vehicles from those companies. The joint venture survived and was incorporated into National coaches in 1970; National Express still operate some services through the tunnel today

Lastly we mustn't forget the two unique vehicles built in 1962 to clear broken-down vehicles from the tunnel. They were built onto the familiar Scammel mechanical horse (much used by British Railways) and survived until they were replaced by more conventional breakdown trucks in the 1970s. Now the breakdown service is put out to tender, although the tunnel authority themselves do have some Range Rover 4x4 vehicles with emergency equipment. Fire cover and heavy rescue is carried out by Kent fire service from its Thameside station and by Essex fire service from its impressive new Thurrock station built a couple of years ago to replace Grays and Tilbury stations.

Addendum

Following a number of disastrous fires in mainland European road tunnels, an appraisal of British road tunnels' safety arrangements (or lack of them) has led to consideration being given to the installation of a fire sprinkler system in the Dartford (Kent) - Thurrock (Essex) tunnels.

One relevant factor in the Dartford tunnels' case is that the two bores are linked by only a single cross-passage. This narrow, sloping tunnel section was made to assist in tunnelling, and is unsuitable for emergency access in the event of a vehicle and its load catching fire in a running tunnel.

SOURCE: Ed OWEN, 2008, Dartford tunnel to retrofit fire sprinklers. New Civil Engineer, 17 January 2008, page 6.

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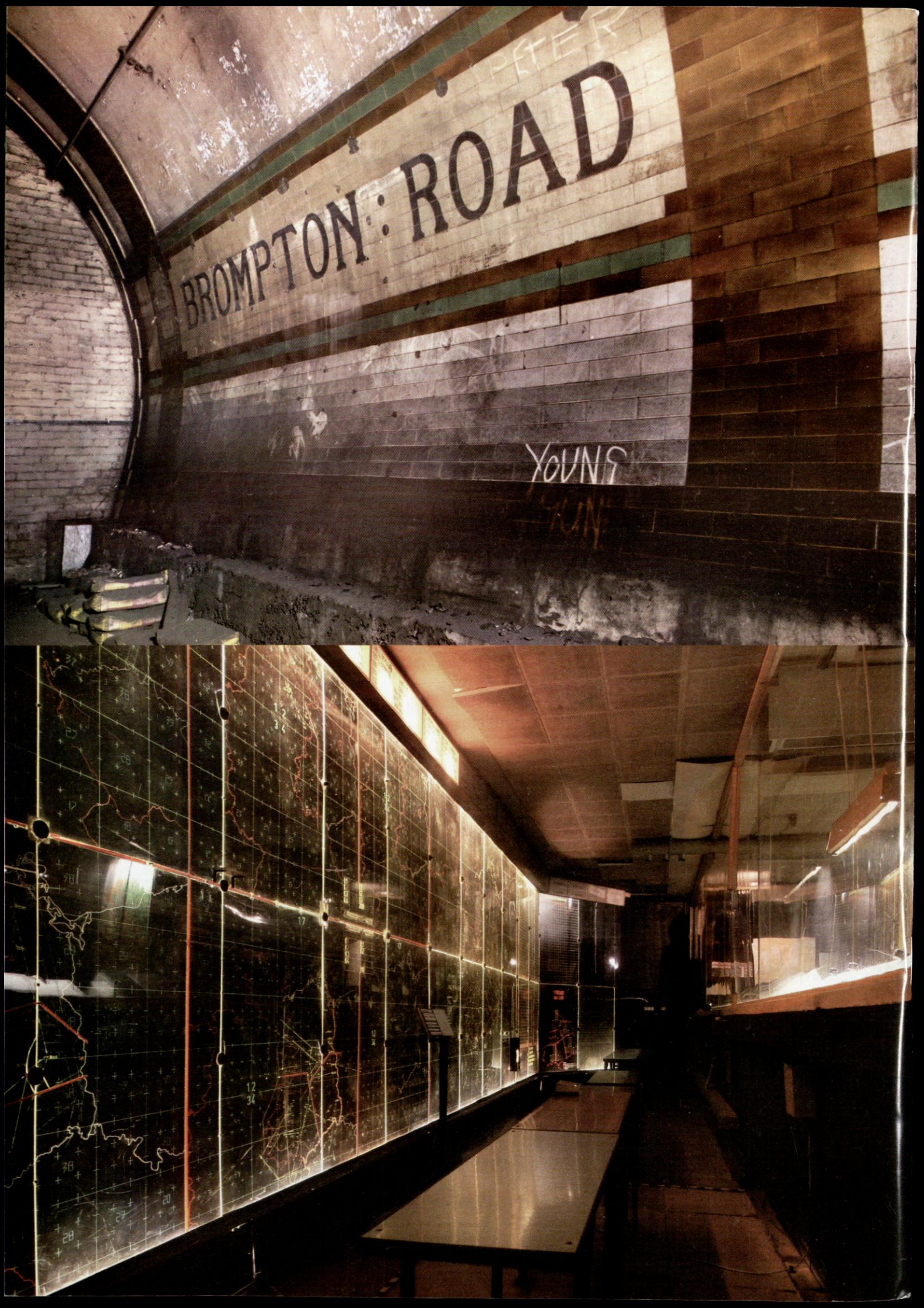
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